OCTOBER, 1937
Vol. I. No. 5

ONE SHILLING

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

■ *Synthetic Resins* ■ *Casein* ■ *Rubber* ■ *Cellulose Compositions* ■

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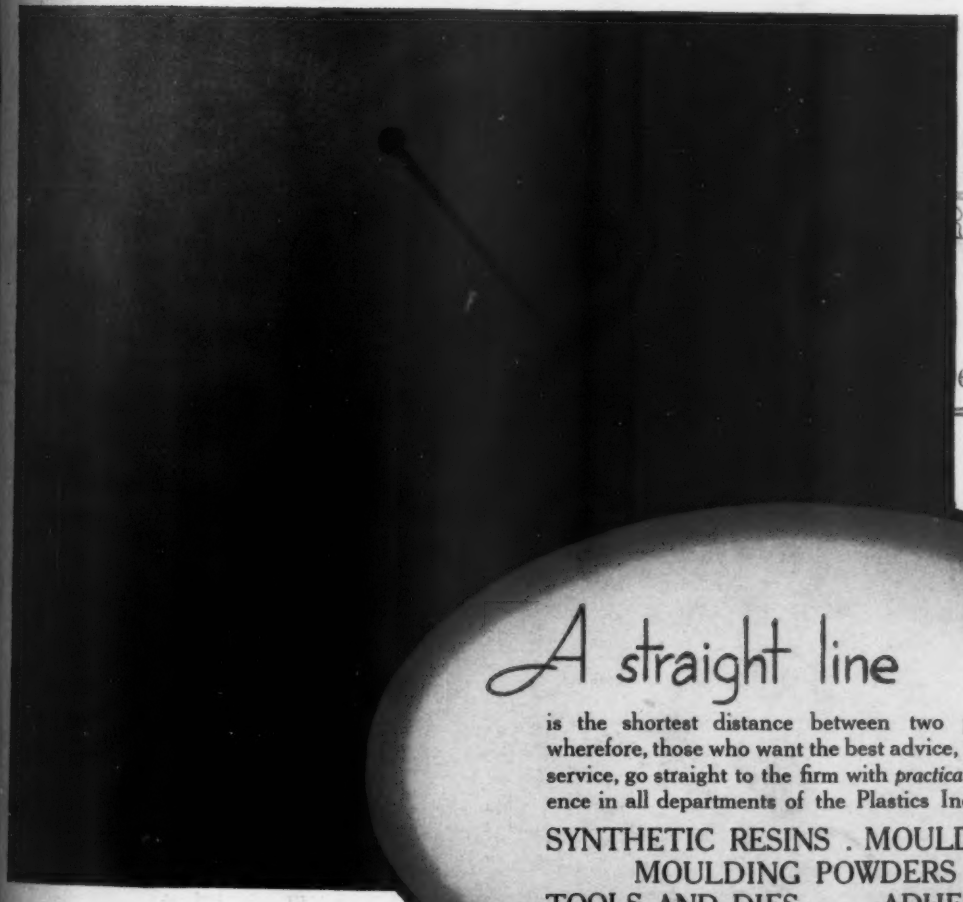

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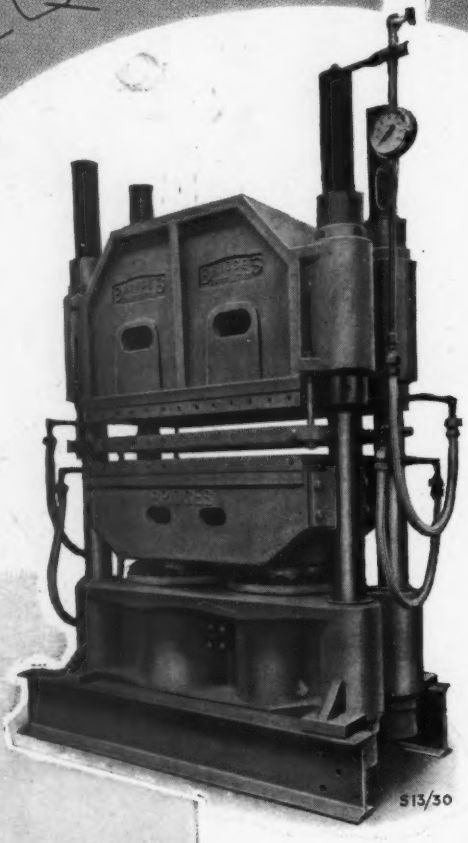

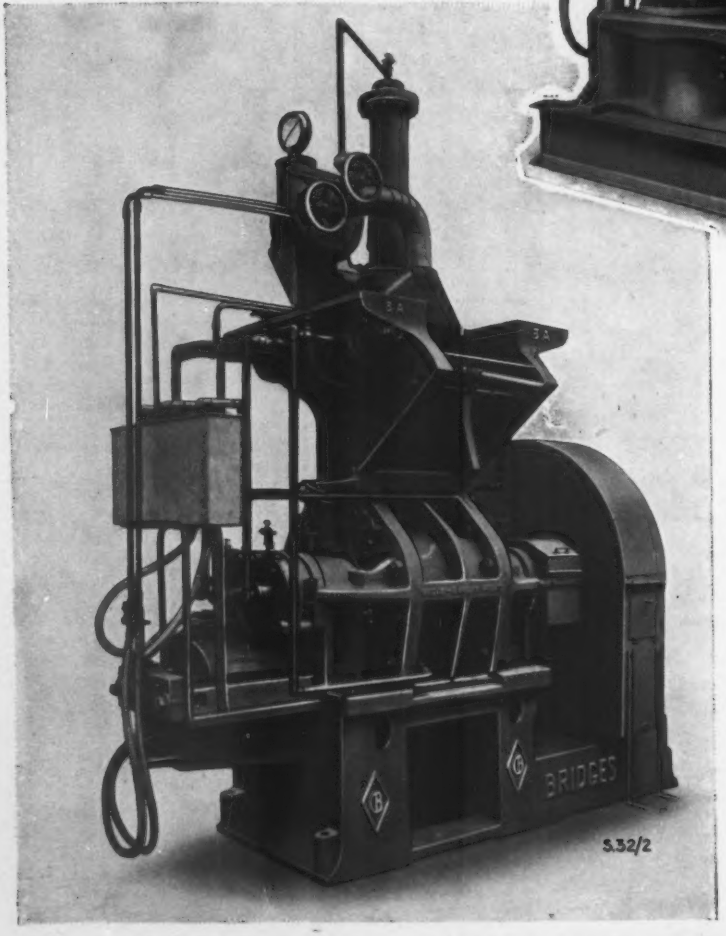

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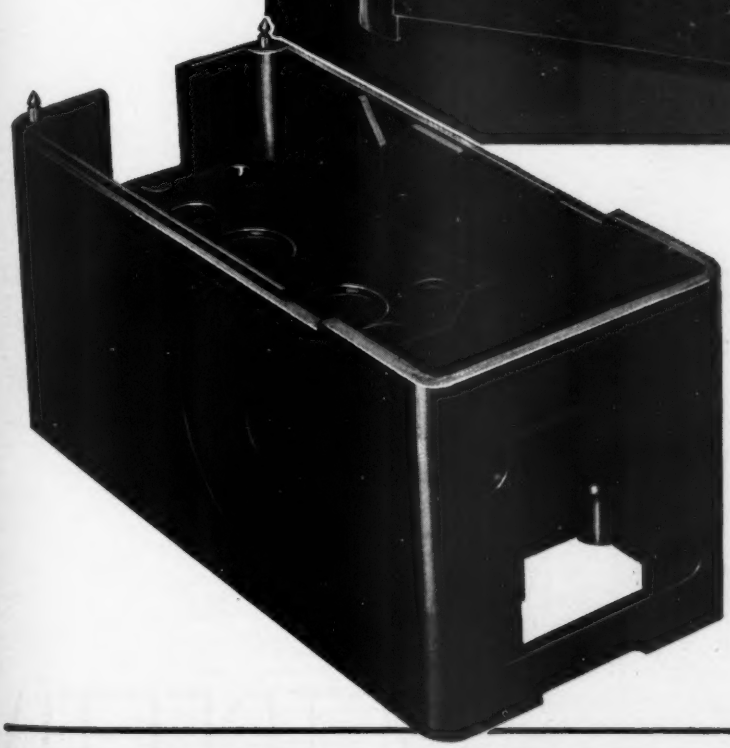

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Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials.

Vol. 1. OCTOBER, 1937 No. 5

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"PLASTICS" is published in London, England, at the beginning of each month.

Head Offices: 5-17, Rosebery Avenue, London, E.C.1.

Inland Telegrams: "*Pressimus, Smith, London.*"
Cables - - "*Pressimus, London.*"
Telephone - *Terminus 3636 (Private Exchange).*

Midland Offices — Birmingham: 61/65 New Street.
Telephone—Midland 4117 (3 lines).
Telegrams—"Presswork, Birmingham."

Coventry—6, Warwick Row.
Telephone—Coventry 4775.
Telegrams—"Presswork, Coventry."

Northern Offices—Manchester: Deansgate House, 274, Deansgate.
Telephone—Blackfriars 5038-9.
Telegrams—"Presswork, Manchester."

SUBSCRIPTION—"PLASTICS" will be mailed regularly to any address in the United Kingdom or abroad for—

Twelve issues for 15s. post free; Canada and Newfoundland, 12 for 13s. 6d.; pro rata for fewer numbers.

COMMUNICATIONS—All letters regarding subscriptions, advertisements and other business matters must be addressed to The Manager, 5-17, Rosebery Avenue, London, E.C.1.

TEMPLE PRESS LIMITED

Proprietors, Printers and Publishers of "The Motor," "The Light Car," "The Commercial Motor," "Motor Cycling," "Cycling," "The Motor Ship," "The Motor Boat," "The Oil Engine" and "The Aeroplane."

5-17, Rosebery Avenue, London, E.C.1

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Vol. I. No. 5. OCTOBER, 1937

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - TEMPLE PRESS LIMITED
Managing Director - ROLAND E. DANGERFIELD

Editor - - M. D. CURWEN, B.Sc., A.I.C.
Offices - 5-17, Rosebery Avenue, London, E.C.1

LUMINOUS PLASTICS

IN our last issue, in answer to a reader who wished for details regarding the possibilities of incorporating certain luminous chemicals into moulding powders and the like, we gave an indication of how it could be done and what the applications might be. The truth was that we had never seen a luminous-plastic moulding in this country and the suggestions we gave—theatre decorations, road signs, display articles, toys, etc.—were derived from a knowledge of the use of luminous paints in this country.

Within a week of publishing these remarks we had received communications from two firms, one French and one Belgian, and a visit from a Mr. Noble, who had just arrived in this country from France to introduce moulding powders for luminous plastics here.

Somebody has said somewhere: "They order these things better in France," and without agreeing with this statement generally, we presume that each nation can do certain things better than other nations. The French have attained an eminence in certain branches of life and industry not reached by any other—the Paris Exposition now showing demonstrates this admirably, especially in industrial art.

In chemical manufacture it is well known, for example, that France excels in electro-chemistry and in dyeing. The production of luminous paints—an extremely difficult manufacture—is another example, so that the production of luminous plastics is obviously the next step.

Apparently luminous plastics are produced somewhat after the manner we have described, that is, by the incorporation of certain sulphur compounds, such as barium or calcium sulphides of extreme purity, with, say, cellulose-acetate powder, from which mouldings and sheets are prepared. The sulphides under the action of light undergo a curious chemical change in which energy in the form of light is given out again. This light, which is not an ordinary white light but of a wavelength depending on the constituent metal (e.g., barium) that is used, is easily visible in the dark. The manufacturers claim that the goods moulded from luminous-plastic powders are able to retain their luminosity for over 80 hours, after which time the material must be re-activated by exposure to sunlight or electric light before it can again be visible in the dark.

Now, although one can visualize many uses of luminous plastics, it comes as a shock to find the really great possibilities of these new materials and, moreover, to find that in this country they are scarcely known. What is more important, they are extensively used in France, not merely as a rather clever form of amusing decoration, but in industry.

Broadly speaking, in industry the use is obviously of value where machinery, through some more or less temporary stoppage in the lighting system, must continue working. An electricity station is an obvious example, where indicators, switch-gear handles, control levers, or even telephones, must be easily attainable in darkness. Similarly, in most works, where important pressure or level gauges, important exit doors, dials, and so on, are under constant supervision. It must be remembered that lighting fails not merely because of breakdown at the electricity station. It may also fail through fuses (and all fuse boxes should be made of luminous plastics) or fire. And to-day, unfortunately, we must be prepared for the cessation of light through air-raid precautions.

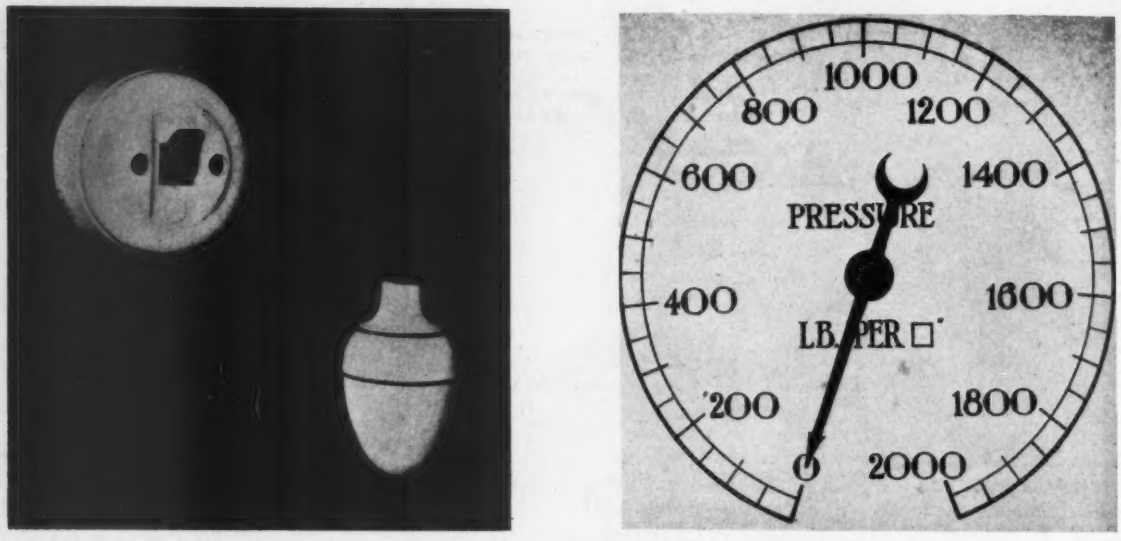
We are informed, too, that almost every French battleship and submarine is provided with luminous plastics. In the naval world it often happens that, even on manœuvres, all lights are extinguished, so that sighting rods, control handles and indicators of many descriptions are made of or provided with some form of luminous material. Within gun turrets (for electric-light bulbs often break with concussion) luminous breech-block handles and breech-opening indicators are provided.

To turn to more normal things, some of the suggested applications and those in actual use are extremely interesting. Obviously, there are electric-light, wall and hanging switches, fuse boxes, bell-pushes, keyhole plates for the night wanderer; and for the invalid there are tumbler holders, feeding-bottle stands or vacuum-flask holders.

For automobiles, we may yet see dashboard instrument dials to eliminate the interior lighting system, brake-lever handles or auxiliary rear lights. For railways are suggested "corridor" signs, station name

boards and tunnel and bridge "corner" signs. On ships, directional arrows in gangways, hand-rail and stair indicators, telegraph dials and edge outline of lifeboats are obvious applications. Many more suggestions can be made on due consideration by most readers.

For our own amusement and interest, we have obtained some examples of luminous plastics. These we have photographed, using panchromatic plates, merely by the aid of the light emitted by the objects. The results are very effective. To the naked eye the pieces are very visible with a bluish light. The pressure-gauge "dial" was merely painted on a sheet of luminous plastic in this office and then exposed to the camera in the dark.



Luminous plastic materials photographed "in the dark."

The Artist and Plastics Design

ON the eve of going to press the inaugural meeting of the Plastics Section of the Society of Industrial Artists has taken place. We regard its formation with the utmost pleasure and with the conviction that it will help plastics and the whole plastics industry to attain more rapidly their proper positions in the world of industry and art.

Many hard words have been said of art in industry, and it is admitted that the expression "art in industry" has been overworked by many over-zealous people. But if there is an industry which needs artistic guidance and the elaboration of a new form because of plastics' own peculiar properties, it is our own.

Happily, the bad days of putting any odd draughtsman not very efficient at his own job on to a new design are over, and many works have their designer, who is also an artist. Happily, too, the industrial artist is beginning to understand that art alone is not sufficient and that an understanding of plastics and of the technique of moulding is important for economic production. More important still is the growing collaboration of moulder and artist, and so we see the interest taken in our industry by such artist-designers as the Industrial Design Partnership, and Consultants, Ltd., two organizations which have produced many designs in plastics of considerable merit, some, indeed, that have raised the standard greatly.

We believe nothing but good can come of real collaboration with this new group; we are equally convinced that it will serve with us in dissipating for ever the erroneous idea that plastics must necessarily be cheap substitutes and in spreading the gospel that they have an intrinsic value of their own.

Plastics Production During 1935

ACCORDING to the recently published Board of Trade Journal, Report No. 16, both the rubber trade and the plastics industry show a steady expansion, the gross output of the rubber trade being £27,749,000 in 1935. Reclaimed rubber increased from 7,588 tons in 1934 to 9,579 tons in 1935.

The plastic materials trade did not appear as a separate entity in the 1930 Census, and in the 1933 Import Duties Act Inquiry it was classed with the fancy articles trade; to-day, however, the activities of this important new industry are given considerable publicity.

In 1933 the total production of synthetic resins in lump and powder (including moulding-powder blocks, sheets and other forms) was 163,800 cwt. In 1934 a similar heading showed a total of 228,200 cwt., to which was added 10,400 cwt. for blocks, sheets, tubes (laminated) and rods. In the 1935 Report the various plastic materials are given under three different headings, solid and liquid, uncured, cured or hardened (of which the 1935 production was 118,600 cwt.) powder (including moulding powder), in which the value of the resin was not less than 50 per cent. (of which the 1935 output was 231,000 cwt.), and blocks, sheets, rods and tubes (laminated), the 1935 production being 14,700 cwt.

The 1933 production of casein, celluloid, xylonite and the like in sheets, tubes and rods, etc., was 89,800 cwt., the 1934 100,800 cwt., and the 1935 93,900 cwt.

The 1934 production of cellulose acetate, benzyl acetate, and the like, in sheets, rods, etc., was 5,000 cwt. and the 1935 at 6,700 cwt., the values being £90,000 and £116,000 respectively.

The Laboratory Creates a Market

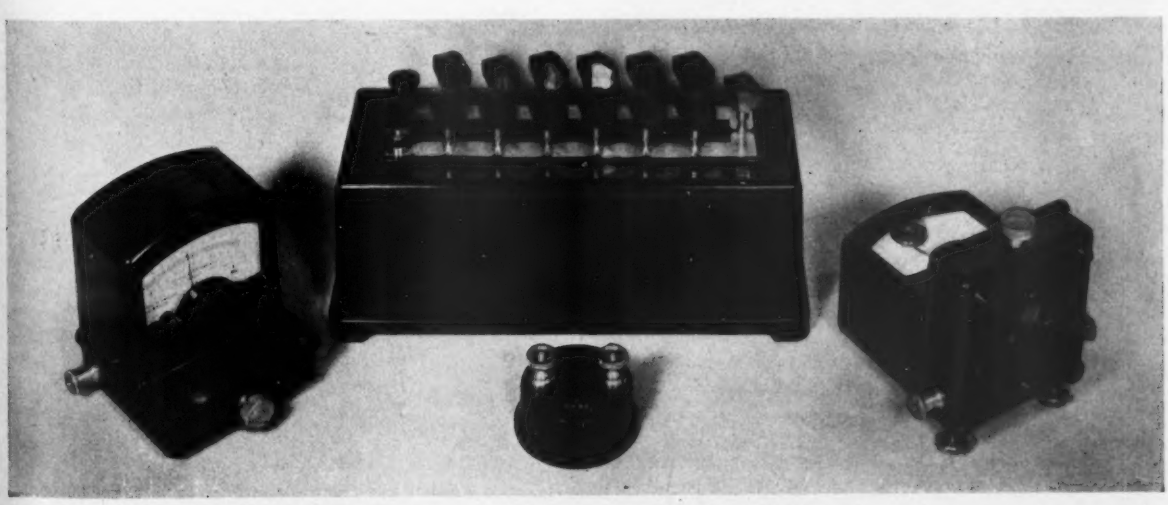
Present and Future Applications of Plastics

A modern research laboratory

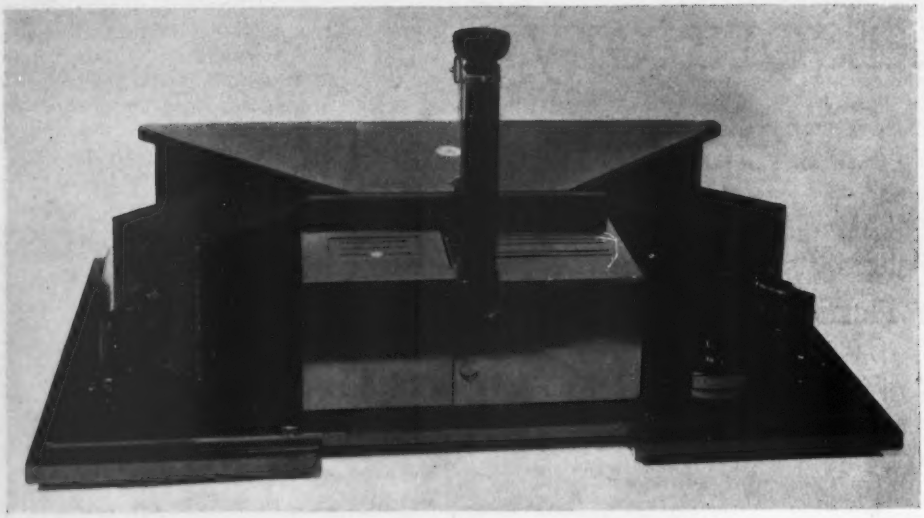
IN chemical and physical laboratories plastic mouldings, as well as cast equipment, are finding important new uses, many of which, owing to their highly specialized character, are practically unknown to the trade in general.

The entrance of plastic materials into the laboratory is noticeable by the fact that bottles containing crystalline chemicals are usually fitted with moulded closures. The main advantages claimed for these caps over corks are that they are easy to remove or replace and yet effect a very satisfactory seal. Although not suitable for bottles containing highly corrosive and strong oxidizing fluids, such as nitric acid, which demand a tight-fitting ground glass stopper, these moulded caps are recommended for a wide range of dry chemicals.

Bakelite is itself very suitable for use in the laboratory, as it is unaffected by solvents, organic acids and inorganic acids, which are not strong oxidizing agents. Practically all the materials, except a very few in the moulded and laminated group, are affected by alkalies,



Laboratory electrical instruments including the Microid adaptable galvanometer (two positions) Bakelite resistance box and Microid Bakelite resistance.

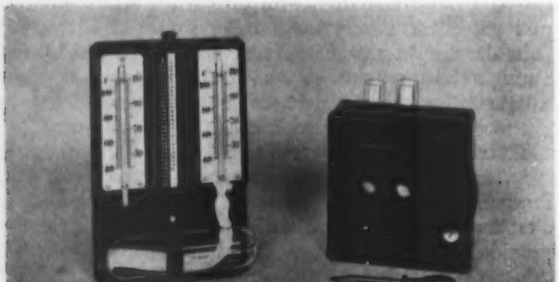


B.D.H. Lovibond Tintometer for use in the measurement of colour.

such as sodium hydroxide, in concentrations exceeding 5 per cent.

Bakelite laboratory ware, such as graduated vessels and beakers, is made by Eimer and Amend, of New York, U.S.A., for special work, as it is able to withstand the action of fluids like hydrofluoric acid, which normally attacks glass.

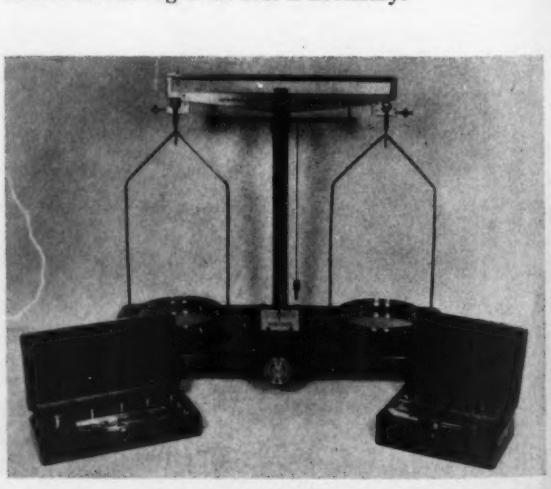
Apart from the use of plastic laboratory ware, and this is becoming increasingly important for research, mouldings of phenol formaldehyde resin are being widely used for casing various testing devices; also for



The "Humidiguide" (an instrument for the measurement of relative humidity) and the Lovibond Comparator.

the supports and parts of optical and other scientific apparatus. There is, for instance, an analytic ultra-violet ray lamp partly made of plastic material now on the market which is proving eminently serviceable. Griffin and Tatlock, Ltd., scientific instrument makers and laboratory furnishers, state that their experience with Bakelite mouldings has been very satisfactory and they favour their use whenever possible. This firm manufacture Bakelite cases for their stainless steel and brass weights, which are a great advance over the old wooden type of box, and also provide bases for certain types of balance made of the same material. The Microid Bakelite resistance box set rather a problem to the moulders, but it was completely solved and is to-day a particularly fine example of what can be done in a specialized field with this material. The British Drug House Tintometer and Comparator, also the B.D.H. pattern Nessleriser, are other notable examples of the use of plastic materials for laboratory furnishing. It is no exaggeration to say that mouldings are becoming more popular with scientists, as, unlike wood and metal, they do not warp, crack, discolour or rust, and they retain their clean, smooth surface in perfect condition even after long and trying service.

Teak is usually specified for the best laboratory benches, but there seems no reason why a strong, reinforced resinous material, such as Bakelite, Formica and Micarta, should not be used. In works laboratories, such as those dealing with cosmetics, foods, paint, oils, etc., but not handling nitric acid or strong oxidizing agents, they would be very serviceable. Incidentally, Messrs. Griffin and Tatlock recently installed a Bakelite-topped bench in the laboratory of Max Factor, Ltd., Park Royal, London. These synthetic materials do not scratch and they withstand high temperatures without blistering. Another great advantage attached to the use of a bench top covered with plastic sheeting is its low cost of maintenance, as an occasional wipe over with a damp cloth is sufficient to remove all deposits. To polish the surface a quick rub over with a chamois leather or soft rag is all that is necessary.



Laboratory weighing apparatus including the Monorider Balance (Bakelite case), Microid brass weights and the Microid tall form stainless steel analytic weights.

ARTIFICIAL SILK FROM CASEIN

SOME months ago we gave publicity to the fact that there was a desire on the part of certain authorities to create new industries in Somerset, one of these being a factory for the production from cows' milk of casein for plastics manufacture.

Within the past month the problem of casein manufacture has assumed even more important dimensions, at least from a scientific if not from an economic point of view, by the endeavour to launch a new project—the manufacture of an artificial silk—this time from casein. We first encountered the patent a few years ago, but to-day the patentee is in this country, together with samples of finished and dyed yarns. These samples have the beautiful soft, glossy feel of real silk and are dyed with most delicate colours.

The production of casein on a large scale is extremely interesting, and not only from the chemical point of view. The material itself can be made and, in fact, is being made, in this country. Several firms of good repute in the dairy industry are producing good-quality material, although in comparatively small quantities, mostly for the production of special foods.

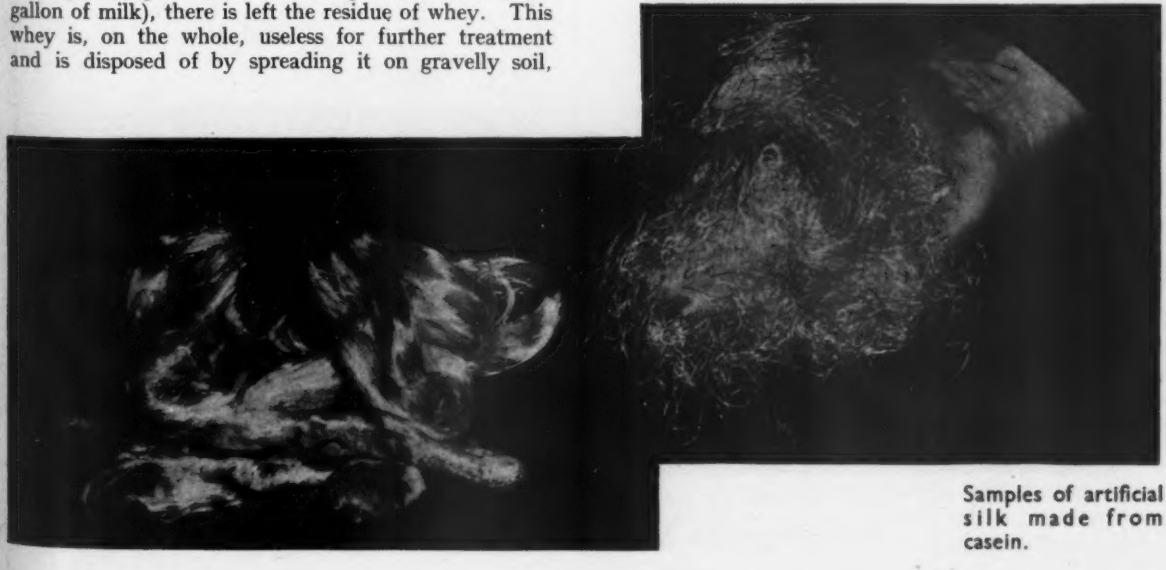
Production, however, on a large scale is not so simple; it means the organization and co-operation of the butter-producing factories, since it is the skimmed milk that is treated with rennet or acid to produce casein. And if artificial silk is to be produced economically, huge quantities of casein and, therefore, skimmed milk, must be readily available. Such large quantities may already be available throughout the country, but its collection is no easy matter. Another school of thought points to the fact that we are importing £44,000,000 of butter yearly from Denmark, New Zealand and other countries and that it is high time we made our own. But, again, we must also have our milk as milk, and since we cannot have our pudding and eat it we must either produce more milk or decide between milk, butter and casein.

There is also yet another point regarding casein manufacture. After the casein is removed from skimmed milk (about ¼ lb. of casein is produced from one gallon of milk), there is left the residue of whey. This whey is, on the whole, useless for further treatment and is disposed of by spreading it on gravelly soil, where it is allowed to drain away. But this process cannot be continued for long, since the soil is soon clogged up and the liquid putrifies rapidly. Large and changing areas of soil are, therefore, unfortunately necessary. This has been not the least of the reasons for the non-development of such schemes. If a large scheme were developed then it would seem reasonable to keep the factories near the sea, so that the great volumes of whey produced could be loaded into barges and dumped reasonably far out to sea where no harm would be done—indeed, it would probably fatten the fish.

To return to artificial silk. The method proposed is very similar in technique to that developed for viscose artificial silk, namely, the forcing of a solution of casein through a spinneret, furnished with very fine holes, into a hardening solution such as formaldehyde, which converts the fine, soft filament to a reasonably strong thread which can be spun. Chemically, "silk" made from casein is much closer to natural silk than are the viscose, acetate or other "rayon" fibres. Both casein and real silk are animal products and both contain nitrogen. All others are made from wood or cotton and none contains nitrogen.

One authority has already stated that if it were possible to make a nitrogen artificial thread it would have the warmth and the colour-accepting properties of natural silk or wool. The samples we have seen have been dyed with ordinary silk dyes and certainly leave little to be desired in respect to colour.

With regard to the strength of the material, results appear conflicting, for one authority has shown it to be rather weaker than other rayon fibres, while another has shown it to be equally as strong. Doubtless the new "silk" can be improved still further by research. It remains for some central authority or strongly organized textile group, in conjunction with our dairy industry, to consider the matter further.



Samples of artificial silk made from casein.

RESIN-IMPREGNATED WOOD

A short description of the work now being carried out on this process at the experimental plant of Halila, Ltd., Slough

IN an editorial in our last issue we indicated some of the possible results that would accrue from the impregnation of wood with plastic materials, such as synthetic resin.

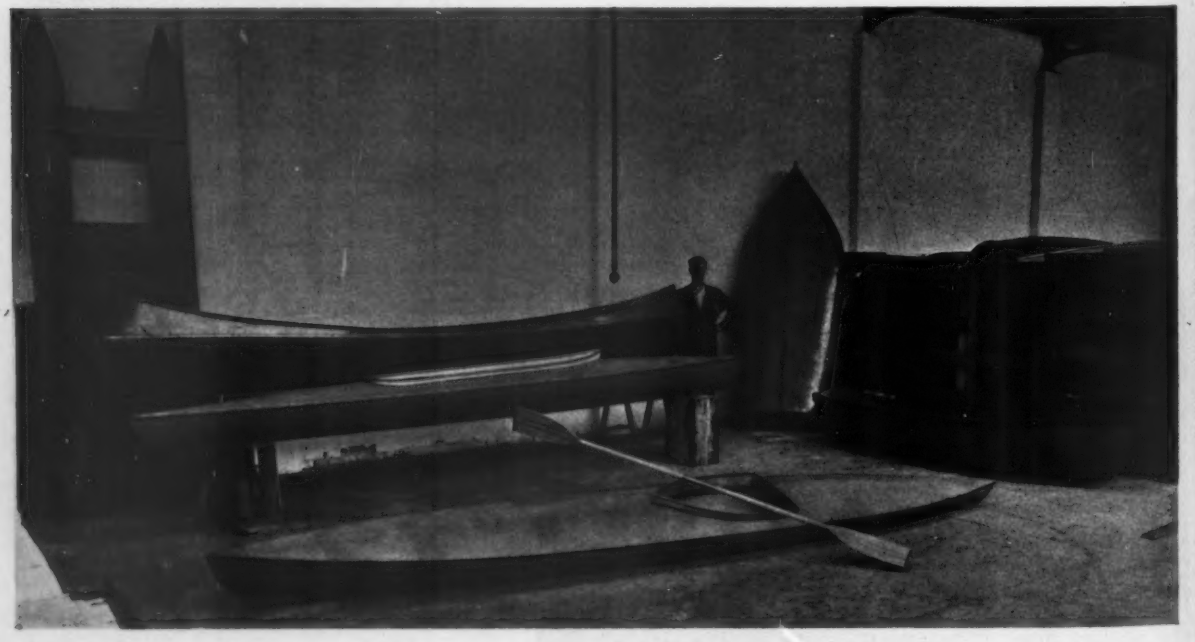
We are now able to give certain data regarding important experiments that are being carried out, and indeed, much of the work has gone beyond mere experiment on the impregnation of wood veneer and the fabrication from this of industrially important structures.

Halila, Ltd., of Slough, were originally interested in the construction of boats and other articles out of separate moulded-to-shape veneers eventually glued together. Naturally they were in need of a cement or glue at once entirely waterproof and capable of uniting wood veneers with great strength at low pressure and temperature. Casein glues are by no means suitable for use in such boat structures, and Tego Film-Glue, by reason of its nature, is precluded from being used. Eventually the possibilities of synthetic resin were examined. After many months of research work, in which they were greatly assisted by Messrs. F. A. Hughes and Co., Ltd., they found a suitable resin, which in conjunction with other very special chemicals gave them what is known as the JIC Process (Jones's Impregnating Cement), for which patents are pending.

A special point about the JIC Process is its controllability. It can be used for impregnation of veneers, it can produce a fine, hard polished surface, and it can be used for adhesion at temperatures under 100 degrees C. For impregnation, low pressures and comparatively low temperatures are employed, and two or more veneers are easily cemented together to form any desired thickness. It is, of course, of the greatest importance to note that the impregnated sheet can be twisted and curved without any sign of cracking of the wood or the synthetic resin. The resin has, in fact, made possible the production of strong structures with acute "curved" angles. Furthermore, as Messrs. Halila, Ltd., own and operate various patents on double-curvature, it has made the use of these patents very important and valuable owing to the fact that presses and moulds for double-curvature are easily and cheaply produced.

The first application of this new process was tested out in the construction of boats and dinghies at Halila, Ltd.'s, own factory in Finland, and after undergoing abnormal tests it proved successful. The canoes, boats and kayaks constructed under the new Process (see photograph) are immensely strong and stand up to any weather conditions. A small plant is now operating at Halila, in Finland, catering for a rapidly growing market.

Another extremely interesting and more recent development is the production of a mechanically moulded, mass-produced barrel of true barrel shape, built up out of two or more impregnated veneers. By this process they score a big advantage over the



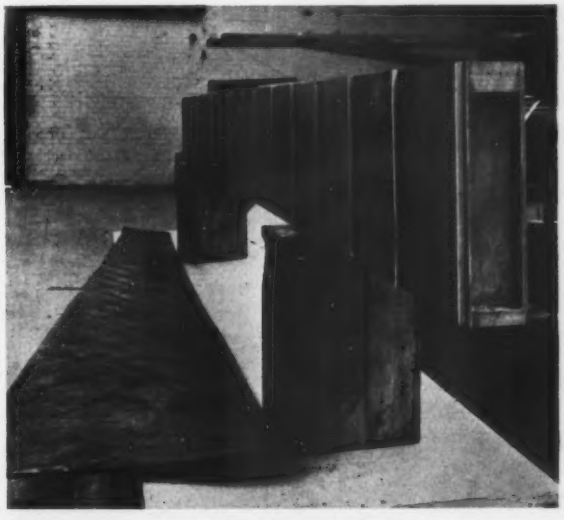
Boats, canoes and kayak of resin-impregnated wood.

old-fashioned barrel, which is made from heavy ½-in. to 1-in. staves in order to render it watertight.

The process consists of using 2-mm. sheets of veneer sprayed internally with JIC, which are then individually shaped to get the necessary double-curvature on a special moulding press. The veneers are scarf-jointed automatically in the process, and the resulting joints being spaced at 120 degrees there is no risk of any weakness at these points.

For example, in the case of a 24-gallon barrel the weight is only 20 lb., which is well under half that of an ordinary barrel of the same capacity. It is also absolutely watertight, and, moreover, in view of the JIC with which it is impregnated and cemented, extremely strong and can hold acidic liquids. For these reasons, and for the great saving in transport and handling costs, it will appeal to the chemical and other industries. One very great advantage which it can claim over the stave barrel is that it needs no steaming or heating to render it watertight, and it may be left for an unlimited period in weather conditions which would normally render the former type of barrel absolutely useless.

Left: The new mass-produced barrel of Jicwood.



Above: Spar for wing structures of the same material.

At present, perhaps most interesting is the development by Halila, Ltd., of impregnated laminations for the aircraft industry. One most significant advance is the ability to produce a resin-impregnated wood with a predetermined resin content at will, and more important, to regulate gradually the resin content of a wooden structure from one end to another. This is especially important in the fabrication of airscrews.

During our visit to these works we were shown an example of airscrew material. It was a block of highly impregnated birch wood, which had a density which decreased gradually from one end to the other from 80 lb. per cubic ft. to about 60 lb. per cubic ft. At the densist end the resin content is about 45 per cent. by weight. The variation in density is introduced because it is believed that the perfect airscrew blade should vary steadily in density from root to tip. The root has the highest, since it must cope with great loads and has to provide a fixing point within the hub. The difference in density along the blade brings down the centrifugal load to a minimum.

In actual practice, Halila, Ltd., will make only the blanks for further fabrication by airscrew manufacturers, and do not intend to concern themselves with any shaping of such articles.

At this point it is important to mention the low water absorption of the impregnated material—only 2 per cent. increase by weight after 24 hours' total immersion, thus reducing distortion to a very low figure.

Construction of Spars

The accompanying photograph shows an aeroplane wing spar constructed completely out of Halila's Jicwood, the top edge shown being made of 64 laminations compressed together and the bottom edge of 38. The impregnation of the wood has the result that although the finished material is twice as heavy as spruce, it is three times as strong in compression. The volume of a spar can, therefore, be reduced considerably.

The tensile strength of the compressed material is always in advance of the compressive strength. The aim, therefore, has been to increase the compressive strength without reducing the tensile strength more than necessary. Compression strengths of 18,000 lb. per sq. in. have been obtained with a tensile strength of 28,000 lb. per sq. in. The moisture absorption, as indicated above, is 2 per cent. increase in weight and 2 per cent. increase in volume after 24 hours' total immersion. Shear values up to 5,000 lb. per sq. in. have been obtained on impregnated material with a modulus of elasticity of 4½ million lb. per sq. in. For general practice, however, a modulus of elasticity of 3,000,000 lb.

per sq. in. and a shear of 3,000 lb. suffices and is easily obtained. The weight of the material can be raised to 80 lb. per cubic ft., and can be varied to requirements with reasonable accuracy.

Composite Material

Yet another application of synthetic resin material is the use of Jicwood in conjunction with such material as Onazote. This latter material is a product of the Expanded Rubber Co. at Croydon.

The principle involved in this composite material is that if a thick material (preferably of extreme lightness) is interposed or sandwiched between two thin materials, the resistance to bending of the latter is very greatly increased as the ratio of the bending arc is similarly increased. Thus the resistance to torsion of two pieces of plywood, separated by, but stuck firmly to, a thick layer of Onazote, is very much in excess of the resistance to torsion of the same two pieces of plywood by themselves. Furthermore, this excess is much greater in proportion to the added weight of the Onazote. The above is a rough explanation of the term "stabilizing" which is used in this connection.

The stabilizing is a very great advantage, as it increases considerably the tensile and compression weight-strength ratio.

A flat sheet of composite material ready for shaping.

The composite material is very resistant to water absorption and can be considered as waterproof, as both the JIC and the Onazote have this qualification.

It should here be stated that Messrs. De Havilland hold a patent for the application of this sort of material in aircraft construction. After very lengthy research and numerous tests Halila, Ltd., have succeeded with their JIC Process in satisfying the requirements in regard to a really proper bond between the wooden material and the stabilizer. It was entirely owing to the immense strength of the JIC, especially in curvature, that this was brought about. Messrs. De Havilland's patent is the latest advance on the stressed-skin covering complete with stabilizer. The above photograph shows a sheet of composite material ready for bending into shape, and it can be seen that it has a highly polished synthetic resin surface, which eliminates all normal surface covering. The sheet is then curved on a metal former.

The joining of this material is comparatively easy, as the Jicwood surface is extended and scarfed to the main structure. This form of covering can be used in various parts of aircraft, such as wings and fuselage, and it needs little imagination to see that seaplane floats could be readily manufactured.

With this new material in one of its forms, with its amazing strength, high resistance to water, and ability to be moulded into varying curvatures without embrittlement of internal stress, we can visualize the complete wood-resin machine fuselage, wings, airscrews and spars being made on a mass-production scale.

Depositing Gold on Plastics

By adapting the process discovered by Professor Charles S. Gibson, of Guy's Hospital Medical School, it is possible to deposit thin films of gold on Bakelite and other synthetic resins. Examples of Professor Gibson's work on glass and other surfaces are now on exhibit at the Imperial Institute, South Kensington, London, S.W.

Survey by Indian Lac Cess Committee

As a result of a recent survey by this Committee, the conclusion was reached that India possesses a small but growing industry for synthetic resins, such as Bakelite and Bestolite, primarily intended for insulating equipment. Lac takes first place for cable insulating, and shellac for paints and varnishes, but the immediate and growing popularity of synthetic resins and plastics gives reason to believe that for cellulose paints the natural material will soon be forced out of the market.

TECHNICAL EDUCATION

Borough Polytechnic

At the Borough Polytechnic, London, evening classes in plastics manufacture are being held. These are under the supervision of the principal, Mr. Douglas H. Ingall, D.Sc., F.I.C., F.Inst.P., and deal with the Manufacture, Properties and Uses of Synthetic Resins and Plastics; Technology of Plastics, I and II; and Mould Design, I and II. Students entering these classes will be qualified to sit for the City and Guilds Examination in Plastics, Grade I and Grade II.

Birmingham Central Technical College

A series of classes specially suitable for those engaged in the plastics industry are now being held at the above centre for evening students. A four-years' course is provided, and both practical and theoretical tuition is given in the Technology of Plastic Materials, Moulding Technique and Mould Design.

The Manchester Municipal College of Technology

A three-years' evening course, which comprises lectures and practical work, is available for apprentices and others engaged in the plastics industry. The theory and practice of plastics production, including the natural resins, cellulose plastics, phenolic and amino resins and the latest vinyl, acrylic and styrene materials, are all considered. Moulding technique and design are given special attention.

"General Release"—I

New and Interesting Plastic Goods

THIS Change-oil Reminder, which G.M.C. Mouldings, Ltd., mould for Germ Lubricants, Ltd., is a most useful dashboard fitting. Motorists will find this permanent reminder of the necessity of changing engine oil very useful, and in the end it will save a good deal of trouble.

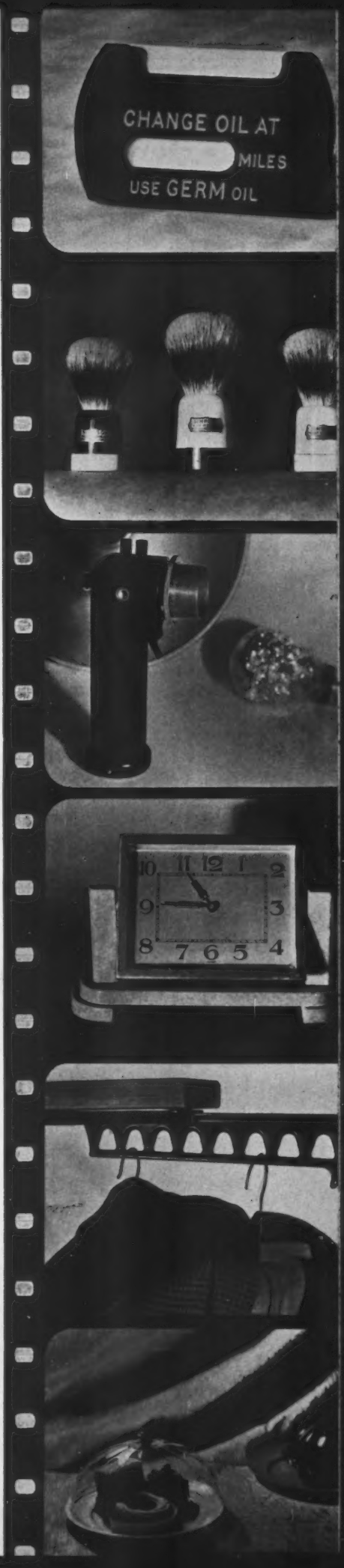
MADE for the famous firm of Simpsons, these fine shaving brushes by Rolls Razor, Ltd., will give many years of constant service without loss of good looks, or, what is more important still, loss of bristles.

PRESS and amateur photographers like the look and feel of this new Sashalite battery holder, which has been designed for an easy, sure grip. It is moulded of Bakelite by the G.E.C., Ltd., at their Birmingham works, for Sashalite, Ltd.

BESIDES being a necessity, a clock may also prove an attraction, and this is justly claimed for the green quartz boudoir clock in Erinoid. It is made by J. Anderson Smith, of Phœnix Place, London, W.C.1.

A WARDROBE hanger that is attractive in appearance and really practical is now on sale at the moderate price of 3s. for the walnut or black and 6s. 9d. for the white and other colours. Evered and Co., Ltd., Smethwick, are responsible for the design and moulding of this new device, which is made of Everite.

THESE cellulose-acetate food covers, made by Phipps Signs, Nottingham, can now be seen in cafés and confectioners' shops, where they keep flies and wasps off cakes and other foods. They not only render the storage of exposed food hygienic, but also add something to its attractiveness.



The New Moulded Sets

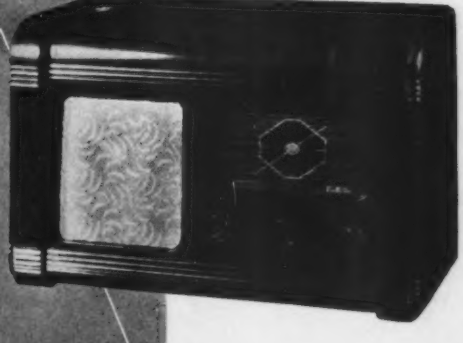
The Ekco set shown in the colour photograph opposite is a new all-wave superhet at 12½ guineas. Spin-wheel tuning is delightfully simple on all wave lengths.

This AC/DC set by Ekco at £6 19s. 6d. is justly popular. The attractive cabinet is a plastic moulding of full standard finish.

Mullard Wireless Service Company present this four-valve all-wave battery superhet of moulded Bakelite for world-wide listening. It is priced at 9 guineas.

A well-known all-wave model for A.C. mains is the Philco Model 8537, which is retailed at £9 15s. and is housed in a handsome black and red plastic cabinet. The cabinet is moulded of Rockite, by Ashdown, Ltd.

G.E.C. straight four-valve mains receiver is yours for £7 15s. This model, in a brown Bakelite cabinet, was displayed at Radiolympia.



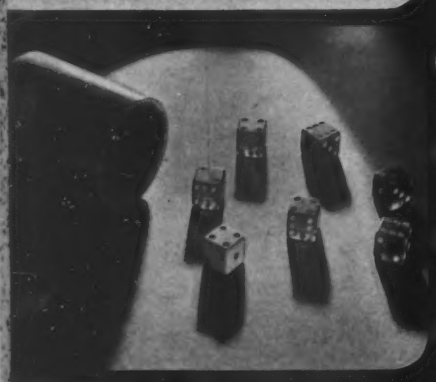
The new Ferranti 837 superhet, selling at 8 guineas, another example of first-class moulded work, is simplicity itself and has only three controls.

Philips' five-valve all-wave superheterodyne set sells at 9½ guineas. The receiver is entirely new, designed on unconventional lines and moulded of Bakelite.

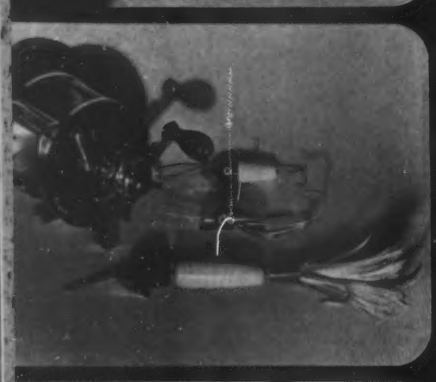
"General Release"—II

New and Interesting Plastic Goods

MOULDED furniture in the doll's house is causing no little comment in toy town, and we don't wonder if it's as finely finished and attractive as these Bex pieces made by the British Xylonite Co., Ltd.



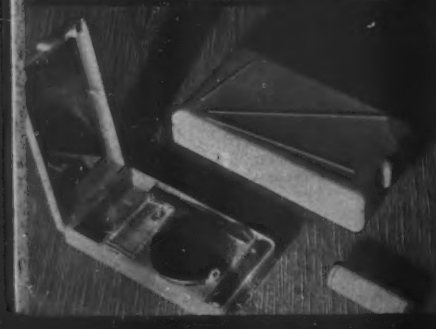
THESE dice, made of Catalin, are finely finished and specially designed for easy, quick handling. Although not expert dice-throwers ourselves, we can quite imagine plenty of enthusiasm being aroused when "naturals" come up in quick succession.



THIS formidable and remarkably efficient tackle, made almost entirely of Catalin, should prove an irresistible temptation to the enthusiastic disciple of Izaak Walton. We hope it will not encourage more of those "fishy" stories!

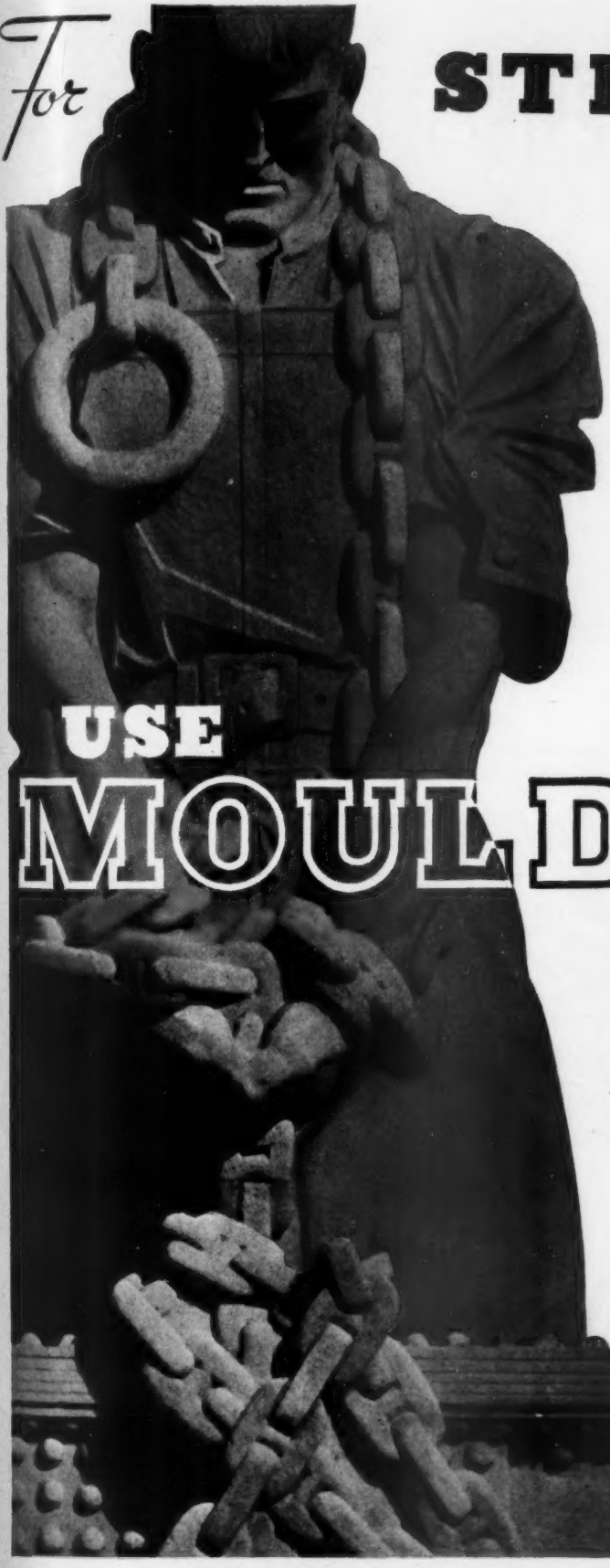
A NOVEL device known as Tel-A-Patient, which was specially designed for the convenience of the busy G.P. and his patients in small American towns, is proving a great success. It is moulded of brown material to harmonize with furnishings. One of the best features of the Tel-A-Patient is its internal lighting, which shows the lettering against a brilliant white ground that immediately catches the eye. A button is provided to change the lettering In or Out and also time of doctor's arrival. Plastic Moldings Corporation mould it for B. and H. Speciality Co., Indianapolis, U.S.A.

WINDOW appeal is given new emphasis with these finely made transparent cellulose containers for dainty, colourful footwear. The containers are made by the Celluloid Corporation of America, and the material is cellulose acetate.



HOLDING practically all the cosmetic aids to beauty now demanded by Miss 1937, this latest addition to the Souplex range should make a wide appeal. There are eight separate units in the new lady's beauty compact, and it is to be retailed at 5s. Souplex, Ltd., Morecambe, Lancs, are responsible for this moulding, which is carried out in amino resin.

For **STRENGTH**



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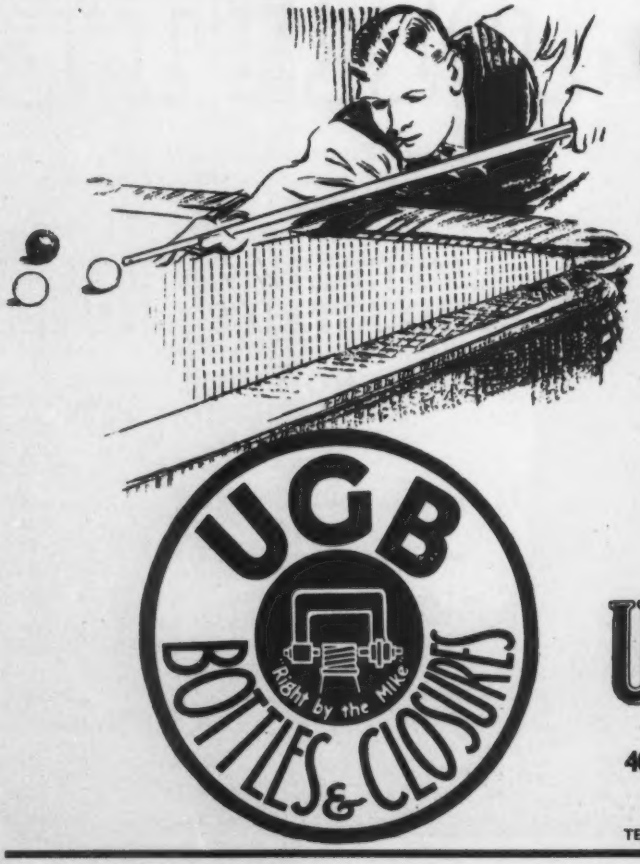

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ÇA C'EST PARIS !

Paris by night and day. The spiral at the top is made almost entirely of Rhodoid.

"PARIS c'est une blonde," sang the beloved Mistinguett, but blonde or brunette, Paris to-day is making an enthusiastic appeal to visitors from all over the world. The Exposition has become the Mecca of pilgrims from industry, science, the arts and many other interests. This is not to be wondered at when one considers the variety, beauty and extent of this gesture of international showmanship, which embraces over 250 acres of ground and reflects the life and industry of 44 nations.

Wide differences of opinion are, no doubt, inevitable when it comes to matters covering so many conflicting interests, but for ourselves we congratulate M. Jacques Greber, official architect in charge of the Exposition, for the bold, yet artistic, way it has been planned right in the centre of Paris. The position on both banks of the Seine could hardly be improved, and France's picturesque river certainly adds a great deal of charm and attractiveness to the scene, especially at night, when the river fountains play in pools of richly coloured lights. In the centre of the Exposition is the Eiffel Tower, brilliantly illuminated with neon and floods and towering like some mighty guardian over this glittering world fair.

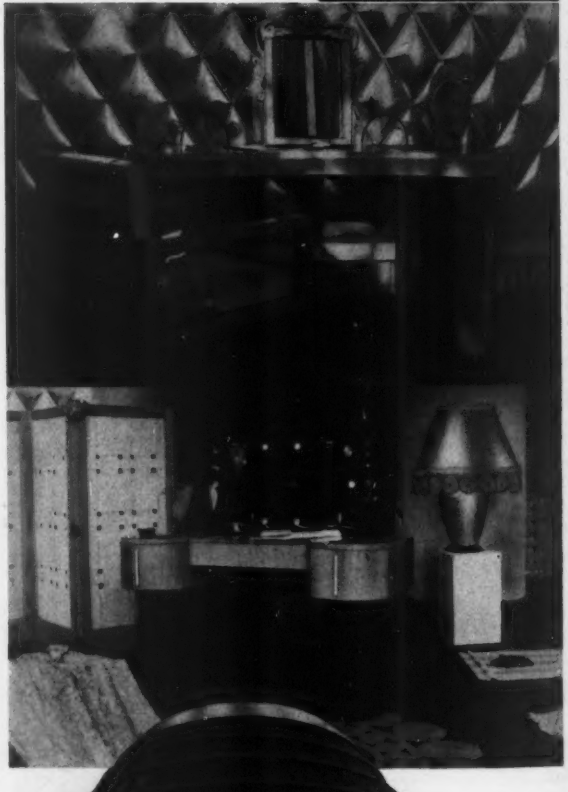
In the history of exhibitions, international or otherwise, it is certain that plastics have never before made such extensive and important contributions as they have to the Exposition Internationale, Paris. Apart from the Pavillon des Matières Plastiques, with its wealth of decorative work in thermo-setting and thermo-plastic materials, large and elaborate buildings and towers are covered with transparent, sparkling cellulose sheeting. In bright sunlight the walls and roof of the Palais de l'Air, Pavillon des Arts Feminins, le Tour du Vin and several others, covered almost entirely of Rhodoid, are a blaze of sparkling light which at once attracts and holds the visitors' wonder and interest.

There is no question of plastics being a blushing violet unseen on the banks of the Seine, as even a

Interior of the Matieres Plastiques Pavillon, showing the centre exhibit made of fluorescent cellulose acetate.

The floodlights on the Eiffel Tower are all provided with coloured plastic reflectors.

(Below) Plastics in the bedroom. Two charming layouts in Rhodoid.



The Palais de l'Air is covered with sheets of cellulose acetate

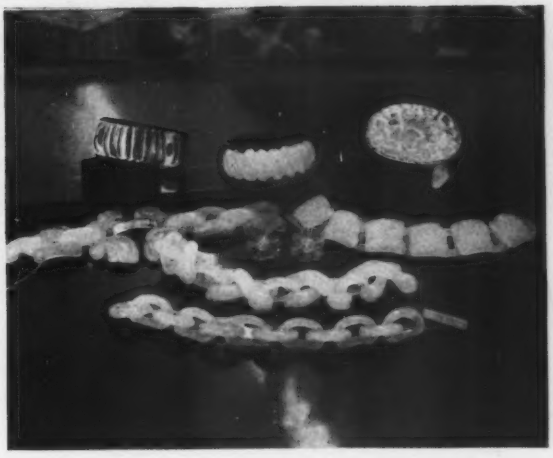
casual walk through the grounds of the Exposition reveals many outstanding, often novel, uses. The "banana" trees in gay shades of green and brown, which can be seen in the French colonial section, are almost entirely made of Rhodoid, and so also are the lanterns, in all kinds of extravagant shapes, which make attractive patterns against the azure sky. Some of the decorative towers made of cellulose material are unusually attractive and create focal points of interest in what might easily be rather dull patches of the Exhibition.

In many of the most important pavilions plastics can be seen in various forms; for instance, in the "Union des Artistes Modernes" there are some fine examples of Rhodoid furniture designed by M. M. Andre, also somewhat similar work by M. Petit in the "Artistes Decorateurs" and Kohlmann in the "Pavillon du Meuble."

The Pavillon des Matières Plastiques deserves a visit by every single person connected or interested in the plastics industry. The mural decorations are unusually effective, both as regards colour treatment and design, and illustrate a catholic choice of synthetic materials which include urea resins, such as Pollopas, also Rhodoid, and the Continental equivalent of Perspex known as Plexiglas, Bakelite and several other well-known varieties. Cunning use has been made of new fluorescent cellulose acetate sheeting in the erection of one of the main stands, and the manufacturers have received a large number of promising inquiries as a result of their novel display.

The designer can find much of interest in many of the exhibits in the Pavillon des Matières Plastiques, which are certainly more ornate than we are accustomed to in this country and yet escape being classified as "fussy." Considerable freedom has been given to the originators of the furniture, wall panels, carpets and other furnishings made of plastic materials, all of which are modernistically planned, yet exploiting to good advantage the peculiar properties of the materials.

An occasional table made of Rhodoid on which are plastic bound books and a box designed by Bonaz.



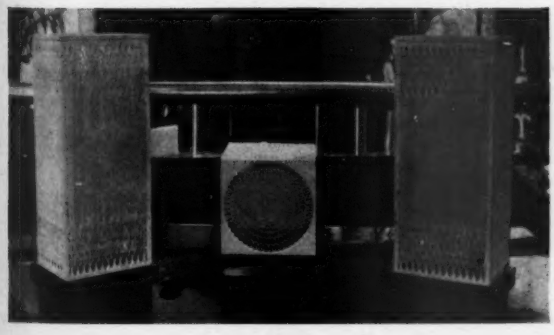
Examples of plastic jewellery in the Matieres Plastiques Pavillon.

Colours, also, are a good deal brighter and chosen not only with an eye to effect, but also to harmonize and tone with similar articles. There are, thank goodness, very few "arty" mottles and marbled effects, and a preference is given to clean, fresh-looking shades which seldom offend and generally please. The secretary of the Pavillon gave it as his opinion that the French public adopts a very critical attitude towards both design and colour, and in consequence manufacturers who do not adopt a progressive attitude find their sales lagging behind their more go-ahead competitors. It has been said that the average French buyer is possibly more astute and harder to please than the average Englishman or his wife, and this may be responsible for the somewhat different standards of value existing in the two countries.

It was noticeable that practically all the exhibits were devoted to what might well be called the lighter side of life, that is, furnishings, tableware, etc. There were very few mouldings for the electrical industry, and the attention given to the important part now played by plastics in modern engineering was somewhat scanty. We are inclined to think, from inquiries we have made, that French manufacturers generally are less concerned than we are with this side of the plastics trade.

It is difficult, indeed, to pick out individual items for special mention, but the Rhodoid stand, with its lovely and very realistic artificial flowers, carpets, curtains and other "objets de fantaisie," appealed to us as well illustrating artistry, colour and that innate good taste for which the French are justly famous.

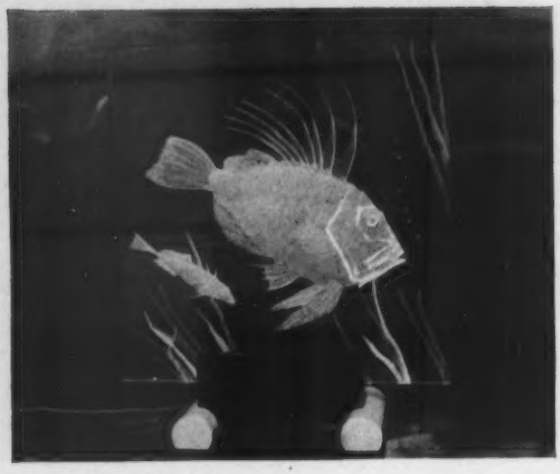
The Palais de la Découverte, a vast and somewhat gloomy building outside the grounds of the Exposition, for entrance to which an extra charge is made, contains many interesting sidelights on plastics production. There is, for instance, one of the latest injection



Flower vases and table lamp made of Rhodoid.

(Above) The screen, wall decoration and dress all owe their origin to cellulose acetate.

(Left) Cafe table made of Bakelite with tableware of Pollopas and Cristallex.



An attractive and unusual lamp made of Plexiglas. Opposite is a floral decoration of Rhodoid

moulding machines which makes medals in commemoration of Paul Schutzenberger, who invented cellulose acetate in 1865, and also two small moulding presses for urea powders. The synthesis of various raw materials, such as urea, used in the industry are explained step by step and make unusually interesting exhibits. Chemical experiments are continually being carried out illustrating important industrial processes, including the manufacture of synthetic resins.

In many other pavilions plastics are shown to advantage. The British Pavilion, designed by Oliver Hill and occupying a somewhat inconspicuous position, has a small section devoted to plastics which certainly does not do justice to our industry and, on the whole, one is given the impression that the plastics trade ranks far behind fox hunting and grouse shooting; these, apparently, being the main pursuits in this country. Both the German and Italian pavilions show a wealth of plastic goods, and the German Government has staged a striking display of Buna rubber, which gives a graphical idea of its production and properties. The Italian exhibits are mainly concerned with very businesslike implements of war, but they also show a varied collection of electrical mouldings, which are not only well and sturdily designed but finely finished.

Hidden away in other pavilions are many exhibits of interest to trade visitors, and everywhere there are ideas to stimulate jaded imaginations. By sea or air go to Paris and see for yourselves. A day will merely act as an aperitif and whet your appetite for more, and still more. Yes! three or four days are necessary for a reasonable survey of this vast wealth of goods and ideas. You'll agree that Mistinguett was right,

"Paris . . . c'est une blonde
Aimée par tout le monde."

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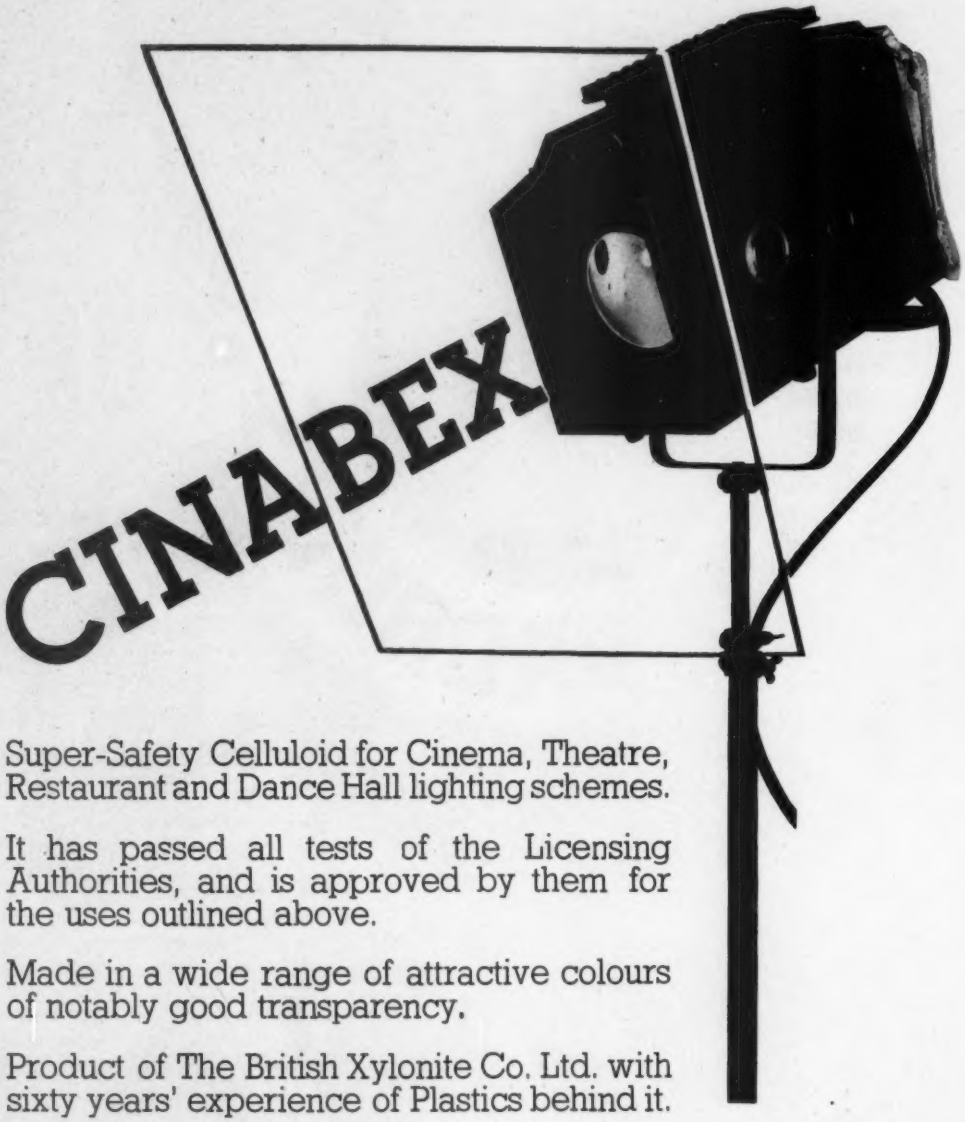

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O.K. for Sound— and Plastics

An interior of Don Luis's Palace in "Anthony Adverse," a Warner Bros. production. Mervyn Leroy gives instructions.

SO young is this marvellous world on the silver screen that many of us have vivid memories of its early days, of acting that carried on, in even a more exaggerated form, the emphasis of the drama and the over-emphasis of the melodrama, until it was realized that the "close-up" brought a microscope to the gestures, moods and emotions of the actor. Such gestures, an essential force on the stage, became merely grotesque and unreal on the screen. So, too, the scenery in the early film studios, borrowed merely from the stage, became crude and tawdry when exposed to the glare of the studio lights and when examined by the searching cinephotographic lens. Just as the make-up of the artistes had to conform to the new conditions, so changed, although much more slowly, the acting technique and the stage effects.

The rolling eyes and posturings of the villain, the heaving bosom of the heroine under emotional strain, and the strutting of the hero are no longer with us on the films. Gone, also, the canvas screens with framed pictures, palm trees and bookshelves painted on them as though by paralytic scenic artists, and gone the shabby furniture that seemed to have travelled round from the Empire Theatre at Mudcombe to the Royalty at Turbot-on-Sea. To-day, for the films, the four corners of the world and the British Museum are ransacked for designs correct to the minutest detail. Anna Neagle, as Queen Victoria, is dressed in robes that even the Lady of Windsor would recognize as her very own. Charles Laughton, as Rembrandt, is dressed as the Dutch painter was dressed and not as a Tyrolean shepherd of the late 19th century. The

furnishings in Don Luis's palace in "Anthony Adverse" are exact replicas of those of the spacious pre-Napoleonic days.

The camera has made us more critical, for figures are more than life-size. Studio technique, with intent, gives us also leisure to examine the background of the story that unfolds, the spacious mountains that give reality to a theme, the furniture that gives character, the very flowers that blossom on the trees.

What part, if any, does plastics play in this wonderful land of make-believe that seems so real, where miracles can appear of everyday happening? Plastics, in the form of the celluloid film, is the very basis of the industry, but there is more to it now than the mere film. The cinema is not slow to seize opportunity.

Perhaps the word "miracle" may give the first clue. Let us read of one of H. G. Wells's miracles and see what he says in "Men-like Gods," that delightful extravaganza in which the chief character is motoring along an English road and suddenly, crashing into the Fourth Dimension, enters "The Wonderful Road."

"The road itself, instead of being the packed-together

A remarkable scene from "Things to Come," the famous film of London Film Productions, Ltd., showing the widespread use of cellulose acetate sheet.

Another view from the same film. The transparent sheet lends spaciousness to the scene.

Gorgeous curtains of plastics are seen in "Top of the Town," a Universal production.

Palm trees and baskets of fruit constructed from Lumarith cellulose acetate. The scene is from "The Big Broadcast of 1937."

pebbles and dirt smeared with tar with a surface of grit-dust and animal excrement of a normal English road, was apparently made of glass, clear in places as still water and in places milky or opalescent, shot with streaks of soft colour or glittering richly with clouds of embedded golden flakes."

Can we doubt that this was a "plastic" road of amino or cast-phenol resin, and how perfectly suited for the cinematic scene of another and beautiful world!

At the kind invitation of London Films Productions, Ltd., we hied ourselves to the famous Denham studios and sought enlightenment at the feet of art directors. We were not disappointed, and learned much.

We were first shown some of the stage props and scenic effects that were used for perhaps the finest example of the application of plastics to cinematic art—Wells's "Things to Come." Immediately it struck us forcibly how fascinating transparency is and what it means to human life: the desire to see things that are hidden by opacity and, perhaps, too, the peculiar emotion aroused by essential purity, for transparency means purity to us all.

The "stills" show us far better than the actual film in action what has been attained. Wells and the film directors wished to portray a brave and clean new world and showed it in the best way—by transparency—

with transparent furniture, amazingly beautiful and transparent columns reaching to the roofs, transparent tubes or lifts that carried a clean people and gave the impression that the very air was some rarefied and miraculous elixir.

For this construction glass was impossible. Great sheets were necessary, or, at least, small sheets that could readily be joined together in the workshops; cylinders and tubes of great size and shapes of strange designs were essential. There must be no breakage. So acetate sheet, as transparent nearly as glass, tough and readily shaped, took its proper place and became the success we see.

It will be argued that this is the only type of film that will be able to employ cellulose acetate, but we do not think this to be true. It is reasonable to suppose that, with the trend of modern art in furniture design, transparency will become more common in everyday life; in fact, the tendency may be towards life such as is portrayed in "Things to Come."

Furthermore, cellulose acetate and similar non-inflammable sheet can be used instead of glass, for windows, swing doors, and so on. In one well-known film, also from the studios of the London Film Productions, Ltd., the swing doors in scenes made to represent the Savoy Hotel were all made in cellulose acetate. Rapidity and ease of cutting and erection and absence of breakages make it the ideal material for the purpose.

We see this leaning to transparency in another sensational way in the spread of the use of "Cellophane" in the cinema world. Its use as headgear and dress material was first applied in the studio and has now penetrated into real use in everyday life. This material in shimmering sheet or strip film has great beauty and created a sensation when used as a glittering curtain in "Transatlantic Trouble," a First National production.

And now that we have the beginnings of real colour films, we have no doubt that art directors will realize its beauty and its adaptability. Indeed, we may then see the introduction of coloured moulded plastics, which, naturally enough, have had no place so far in the scheme of things. Cast phenolic and amino resins would lend a beauty to a scene that no other material can. The coloured synthetic-resin tiled floor that adorns an American millionaire's home, may yet be found in the cinematic dance hall.

Before the "Cellophane" film curtain in "Transatlantic Trouble."

A bevy of beauties in plastic top-hats in "College Holiday."

Rubber in the News

PLIOFILM, which is the registered trade mark identifying the transparent wrapping material manufactured by the Goodyear Tyre and Rubber Co., is finding many interesting applications.

The sheet is manufactured only in moisture-proof grade; this is because of the fact that moisture-proofness is not due to the addition of a surface coating.

In addition to possessing the great advantage of inherent moisture-proofness, Pliofilm is well adapted to heat sealing within a range of temperatures from 220 degrees F. to 260 degrees F., and the heat-sealed joint is as strong as the sheet itself. Its tear resistance is more than twice that of a cellulose wrapper of the same type and it possesses greater stretch and has a greater resistance to punctures.

Pliofilm is available in practically all the colours of the rainbow and finds literally hundreds of uses. In addition to being used for rain capes for women, coats and jackets for men, it is being utilized for women's aprons, umbrellas (through which the user can see where he is going), shower caps, shower curtains, dress-hanger covers, garment bags, furniture covers, oxygen tents and many other purposes.

Ultimately, the greatest market for Pliofilm is expected to result from the demand for its use as a package wrapping material and for wrapping perishable foods for refrigerator storage. Because it is moisture-proof Pliofilm will preserve and protect against drying out or staleness.

New Rubber Corset Material

According to a Canadian Trade Commissioner writing in a recent issue of the *Commercial Intelligence Journal*, the use of fleecy-back perforated rubber is becoming increasingly popular in place of the more usual and less expensive elastic cloth. The perforations which pierce the fleece lining attached to the back of the material are at regular intervals, and so designed that adequate ventilation is assured. The width of the rubber varies, but is usually about 40 ins. or 42 ins.

Replaceable Rubber Heels

H. Van Mourik, of the Van Mourik Associates, Detroit, U.S.A., has designed and perfected an entirely new type of heel which is replaceable, instantly detachable and designed to be interchangeable (left to right).

As now perfected, the heel has three rubber "plugs" about $\frac{3}{8}$ in. in diameter, projecting about $\frac{1}{16}$ in. above the upper surface, on which the heel rests. Four steel lugs are used to fit into slots in the base, firmly attached to the shoe proper, and an additional lug is placed at the front of the heel, serving to fix it on with a slot-like action, which is intensified and made more secure as the wearer walks forward.

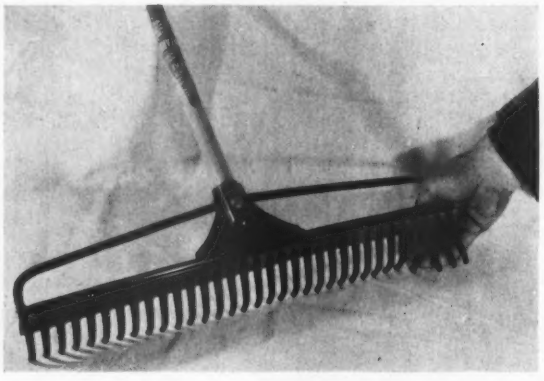
According to *Hide and Leather*, the American organ of the boot and shoe trade, the first pair of shoes made by the Van Mourik method cost the inventor 20,000 dollars. This large outlay has, however, proved well worth while, and there are excellent prospects of the new replaceable heels being taken up by prominent American boot and shoe manufacturers.

Latex Gloves

These new gloves, intended for domestic use, are made of latex sprayed on to fabric, and are now on sale at the principal druggists in this country. They are made in the United States, but home manufacturers are, we understand, studying the possibilities of production. Unlike ordinary rubber gloves, this new type are exceptionally easy to pull on and off and stand up well to hard and constant wear.

Rubber-fingered Lawn Rake

This new lawn rake, manufactured by English Tools, Ltd., Wigan, is provided with pliable rubber fingers that cannot possibly harm the lawn surface. It is remarkably efficient in collecting stones, twigs and litter, and at the same time protects the lawn against scratches. English Tools, Ltd., state that the teeth are scientifically designed to gather firmly and gently, and are unbreakable, pliant and strong. Gardeners should find this novel



gardening implement of considerable service, especially for seeded lawns, where extra care is needed so as to avoid breaking the young shoots. It is already being extensively used for golf and bowling greens, as well as tennis courts. The retail price is 5s. complete, and the rake carries a 12-months' guarantee of satisfaction.

L.M.S. Design a "Floating" Freight Wagon

Claimed to be the first of its kind in the world, an experimental shock-absorbing railway goods wagon was successfully demonstrated by the L.M.S. Railway at their St. Pancras depot, London, a short time ago.

The wagon was designed by the L.M.S. chief mechanical engineer, Mr. A. Stanier, in conjunction with the chief commercial manager's research section, and is the first of an order of 100 to be constructed at the company's wagon works at Derby.

In principle the body of the shock-absorbing wagon "floats" on the chassis by means of an ingenious springing arrangement, while additional protection is given by special shock-absorbing buffers.

The actual shock-absorbing element consists of two sets of horizontal india-rubber springs forming a buffing arrangement between the wagon body and chassis on which it rides, and of four sets of horizontal rubber springs which are attached to the chassis and act in the same way.

The effects of any longitudinal shock delivered to the wagon are largely absorbed in compressing these springs, and to that extent do not reach the body and the goods carried therein. Immediately after the shock the springs quietly reopen, causing the body gently to follow the shock movement of the chassis until it regains its normal central position in readiness for any subsequent shock.

Tests conducted with a small experimental fleet in connection with sanitary tubes, sheet glass in crates, earthenware and china in crates, and similar classes of traffic, have demonstrated the material superiority of this special vehicle in eliminating or minimizing the risk of damage to goods in transit.

Latex for Modern Packaging

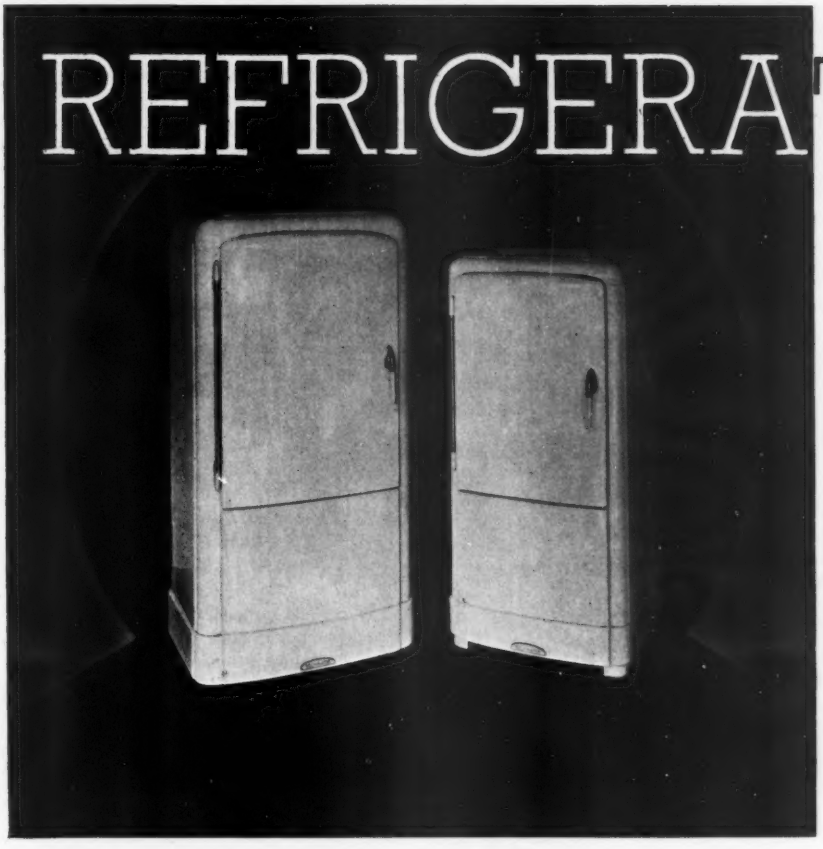
A new toilet accessory known as Blands Razor Bath is designed to obviate blade wiping and keep the edge keen and rust-free by immersing the razor head after use in a jar containing special preservative. Mr. O'Hea, who is responsible for this enterprising device, says that one of his main difficulties in designing the package was to find a way of gripping the haft of the razor and keeping the head upright in the liquid. An ordinary rubber washer, pierced radially, seemed a practical solution until it was found that it deposited sulphur on to the metal handle of the razor. To overcome this difficulty, latex was substituted for ordinary rubber, with very successful results. Blands Razor Bath sells at 1s. 6d. and will give six months' constant service.

Neoprene Tape Now Widely Used in America

This is finding extensive applications for sealing the riveted seams of airplane hulls and pontoons because of its superior ageing qualities. Another use for it takes the form of an insulating strip round the door of the refrigerator. Vegetable and animal fats, in contact with the old-type rubber insulating strip, soon broke down. These do not harm the new Neoprene strips.

Many other important uses are being developed by the Du Pont research station at Fairfield, U.S.A., where a good deal of the early research work on synthetic rubber was carried out.

REFRIGERATION

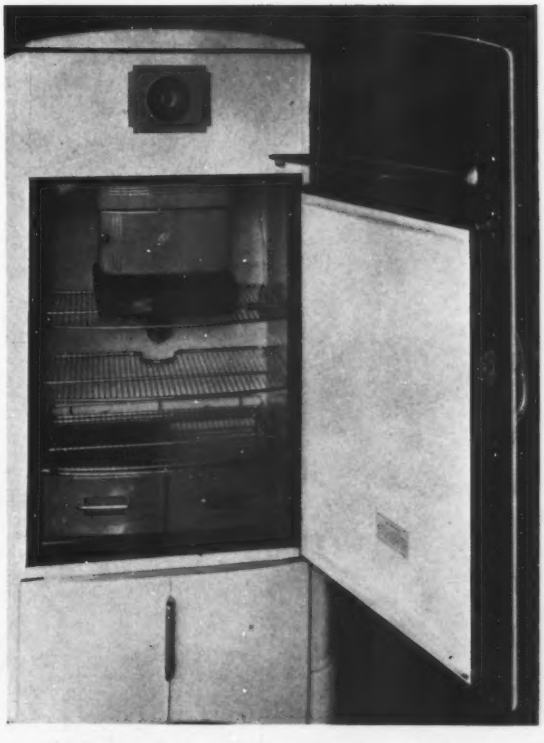


ONCE only a luxury for the very rich, refrigeration is fast becoming a necessity in every middle-class home, because it not only maintains food in a fresh and appetizing condition but also helps to reduce waste.

During the past 10 years remarkable progress has been made in refrigeration, so much so that it is a comparatively simple matter nowadays to maintain temperatures below 50 degrees F. indefinitely without any appreciable variation, and with a good refrigerator this can be done at a cost of only one unit of electricity every 24 hours. Engineers have only been able to achieve this high standard of efficiency as the result of exhaustive research and years of practical experiments, during which time many materials have been tried out and a high percentage rejected on account of their poor insulating and mechanical properties, liability to breakdown when exposed to low temperatures and general unsuitability.

Rubber and synthetic resins must be included among the materials of refrigeration construction, and they are making appreciable contributions both to the efficiency of the apparatus and also to its pleasing appearance. The main reasons why both rubber and synthetic resins are valuable for refrigeration are that they combine high insulating properties with perfect immunity to corrosion of any kind likely to be experienced in a refrigerator. They are also naturally strong and obtainable in the most desirable shapes and sizes suitable for both interior and exterior uses and very economical to produce.

Manufacturers of refrigerators, who from the first have realized the potentialities of rubber and resins

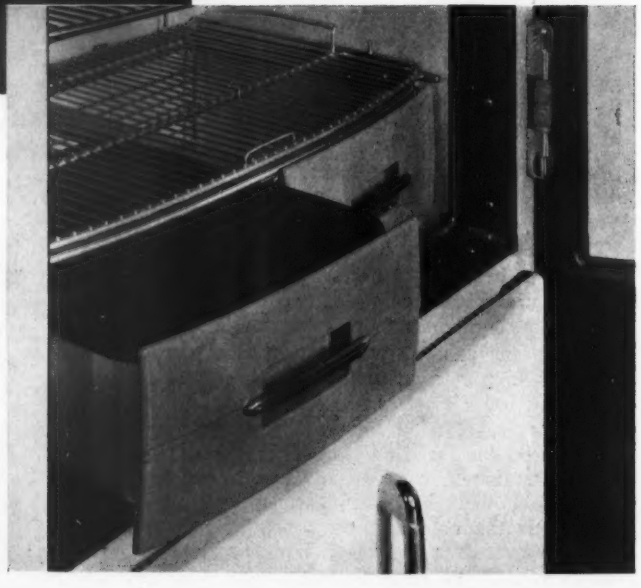


Kelvinator refrigerator showing Plaskon drawer fronts, Bakelite door and compartment trim and rubber gasket between cabinet and cabinet top.

for their cabinets, have initiated very considerable improvements, both in the appearance and properties of these materials. In other words, they have over a period of several years carefully adapted them to their own particular uses, so that to-day they appear to meet the most exacting requirements.

At one time, and that only three or four years ago, the rubber used for gaskets in refrigerators was by no means free from the characteristic rubbery smell, and in consequence it occasionally contaminated certain delicate foods, such as fruit jellies, salads, etc. The disadvantages attached to the use of ordinary rubber were recognized, but the technical difficulties in the way of an improvement of the material proved considerable. Eventually, however, a sulphur-free rubber was produced specially for refrigeration that was completely odourless and tasteless. This is the type now generally adopted by leading refrigerator manufacturers. The Kelvinator, one of the best-known machines on the market to-day, uses this special kind of rubber, not only for gaskets used as a lining for the doors to ensure air-tightness, but also for the partitions in the ice-cube trays, and even for the boxes themselves in certain models.

(Left) Lids of black reinforced Bakelite made by G.M.C. Mouldings, Ltd., for Commercial Kelvinator Freezer. (Below) Plaskon drawer fronts, Bakelite lid and trims, also Plaskon Master Dial for Kelvinator cabinets.



Interior view of the Kelvinator T.U.7 cabinet showing rubber dividing grids for ice making.

Another rather interesting and comparatively recent innovation is the use of the cellular rubber tubing for insulating purposes. The former is an excellent insulator and can be relied upon under all conditions of service. A harder type of rubber, reinforced with small metal inserts, is used in the form of studs to support shelves in the Kelvinator refrigerator, and this novel, but practical, idea is successful.

Plastics find their most important application in the lining of the refrigerator door. Bakelite is the most usual material, and it is screwed to the edges as well as part of the inside of the door, so as to afford the maximum insulation. The same material is also moulded into special-shaped tops for vegetable bins and has the great advantage over metal that it can never corrode, and only needs an occasional wipe over with a damp cloth to keep scrupulously clean.

Rubber dividing grids for ice making. The rubber used is odourless and tasteless.

Special asbestos-reinforced Bakelite mouldings are made to fit the tops of ice-cream cabinets, and these are in many ways preferable to wood or metal, as they are hygienic and easy to keep clean.

In the various models of the Kelvinator refrigerator generous use is made of plastics. For instance, some of the shelves are faced with cream-coloured Plaskon, the well-known American plastic, and the same material used for a lamp shade and indicator.

It should also be mentioned that practically all refrigerator cabinets are finished off with either glyptal or urea resins which give a hard and very attractive porcelain finish fully able to resist abnormal wear and tear.

Novel Juice Dispenser From U.S.A.

This Barnham tomato-juice dispenser, made by the Barnham Dispenser Co. of Milwaukee, is an outstanding and outsize moulding job by the Chicago Molded Products Co. The tomato itself is moulded in halves of scarlet Durez and the base is moulded of bright green Durez. Unlike metal, this material does not chip or scratch.

The dispenser as a whole stands 16 ins. high and has four moulded pieces, including the handle of the agitator at the top, all of which were moulded.

Ideas—

By the EDITOR

Plaques

The Editor of *Verlag Chemic* has been good enough to send me one of the small plaques made from synthetic resin, which were shown at the recent Achema Exhibition in Dusseldorf. This is a welcome surprise following my remarks on synthetic-resin plaques in our June issue, and I hope that British manufacturers will see the great possibilities in this type of work. I am

especially pleased with this plaque, for the producers have secured the services of a well-known German artist, Philipp Becker, to execute the design. Liebig and Wöhler were two of the greatest chemists of the past century.

In passing it is interesting to note that the plaque has been reproduced by the well-known Isoma process of injection moulding.

Plastic Tiles and Similar Matters

I have received an extremely pleasing letter from a Mr. Frank Roberts, roofing contractor, of Nelson, Lancs, *à propos* my remarks on this subject last month; pleasing because he agrees with much of what I said, and also because he has enlarged on them. "I have just received my September issue of *Plastics*," he writes, "and being a 'roofing' man my eyes immediately dropped on your notes on synthetic-resin tiles. I agree a lot with what you say with regard to their possibilities.

"The weight of the tile would be an asset, for it would reduce the cost in many ways: transport, supporting timbers on the roof and fixing costs, for a labourer could carry a lot more in the same time and the tiler could lay more in a given period. He could also lay them all day without feeling excessively tired.

"With regard to colour, almost any could be obtained to suit all architects.

"As for breakages, I think 25 per cent. is nearer the mark, and breakages in fixing and 'making' add considerably to the cost of the fixed tile.

"With regard to the glazed Broseley pattern, the cost is about £8 to £10 per 1,000, but I do not think that, at present, they are a success, for the glaze blows or bursts off."

Dolls in Plastics

Last month I had the pleasure of receiving in this office a toy manufacturer, who came to inquire of the possibilities of manufacturing dolls' heads and limbs of plastic material other than papier mâché and celluloid.

The most obvious material for this job is cellulose acetate, which is quite non-inflammable, can be easily moulded and, moreover, could be given a flesh tint, so that no painting of the finished head need be done except the mouth, eyebrows, etc. In fact, although I have seen no dolls of cellulose acetate in this country, I have seen them in France. They are produced by blowing the acetate into a split-mould with high-pressure air.

Readers who are interested should get into touch with Mr. A. V. Keller, of Inlay Mouldings, Ltd., Grosvenor Road, Ealing, London, whom I believe is the only person in this country who has done a great deal of work on moulding heads from cellulose acetate.

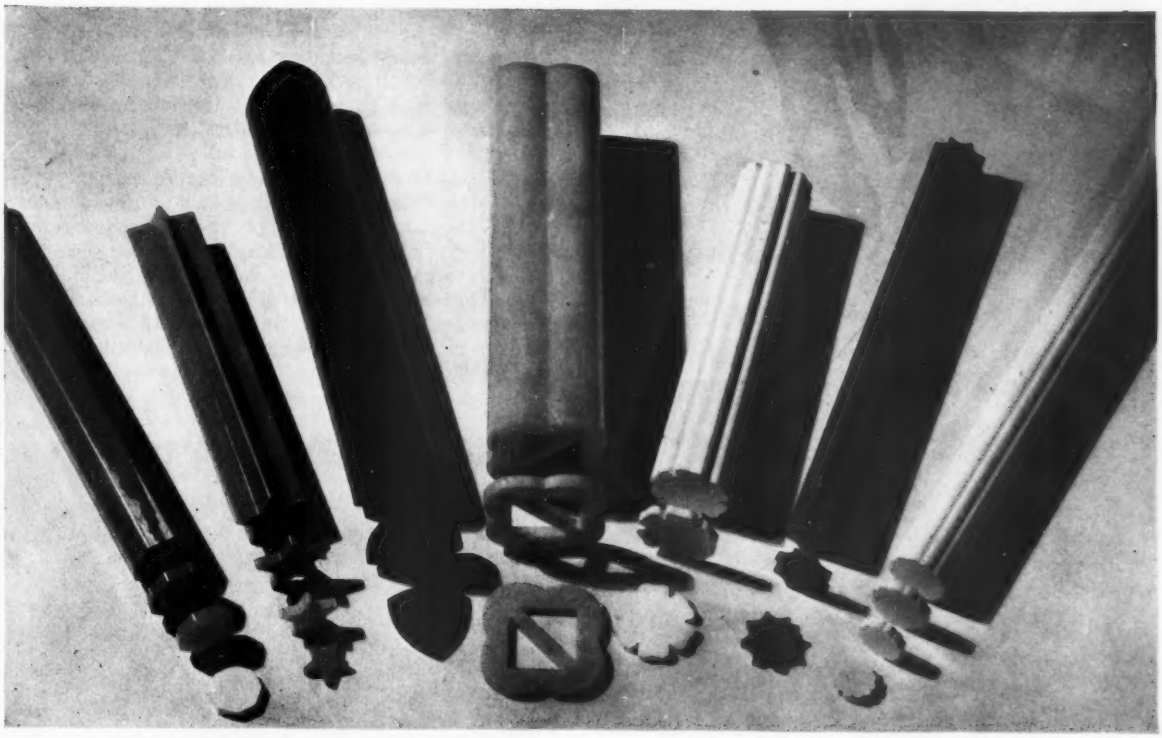
As for other materials, I do not consider the usual moulding powders quite suitable as they are more brittle, of course, than cellulose acetate. Moreover, the actual moulding operations would not be carried out with the same simplicity.

Guinness is Good for You

In our August issue we gave some excellent examples of plastic mouldings that were being used as Christmas presents by large manufacturers in industry, combining a kind thought with a modicum of advertising. It was there pointed out the manifest advantages of making these in plastics—high-quality goods in designs that were often impossible economically in

other materials. The accompanying photograph shows an amusing example of what can be done, a safety razor in Bakelite, in the base of which is a styptic stick mounted on a threaded holder. This excellent moulding has been carried out by Souplex, Ltd., of Morecambe, Lancs, the well-known manufacturers of the Souplex range of safety razors. At the recent Chemists' Exhibition I was informed that Souplex, Ltd., are now moulding for the trade.

The Working of CAST PHENOLIC RESIN



Bars and tubes of Cast Phenolic Resin for producing blanks.

The following notes have been collected with the collaboration of Catalin, Ltd., to whom our thanks are due. The photographs which illustrate them have been supplied by the same company.

WITH the advent of this comparatively new resin it is natural to inquire what this product is like and how, since it is not moulded in the manner of most plastics, it is converted into useful products. Since it has gained considerable popularity in the U.S.A., where some five million pounds are produced yearly, it is reasonable to believe that corresponding use of it will be made in this country.

Like Bakelite and similar phenol-formaldehyde resins, cast phenol resin begins as a liquid, but there the similarity ends. The former are solidified, powdered, mixed with fillers, such as wood flour, and then moulded directly into the finished shape at high temperature and high pressure.

The cast-phenol-resin liquid is used in its pure state (hence the transparency and beautiful colours of the finished product). The liquid resin is cast in somewhat the same way as the casting of metals, but at comparatively low temperatures and in lead moulds, where solidification or hardening occurs only after a prolonged curing of some three days to six days.

What the fabricator receives are either cast rods, tubes, sheets or slabs, or, alternatively, specially shaped castings. The latter are converted into finished articles, such as handles, pipe bits, lamp standards, cutlery parts and the like, with a minimum of machine work. Tubes and rods need not be circular; they may be fluted, square or of any contour.

The lead moulds in which the resin is cast are made by dipping steel forms having the shape of the finished castings into molten lead. The latter freezes on the form in a shell, which is immediately stripped from the form leaving cavities or recesses in which the plastic is cast. After the latter is cured, the lead is stripped off, leaving the solid resin in the shape of the original form. Many stock forms are available, but for special shapes they must be made to the customer's order. As compared to moulds for the moulding plastics, however, the forms are quite inexpensive. In fact, one of the great advantages of using a cast plastic is that no investment in moulds is required.

Because of its great beauty, cast resin is much used for "style" or decorative items. As styles change, as they do very rapidly in the button and costume jewellery fields, the fabricator can, and does, follow (or even anticipate) without the waste in scrapped moulds which would result if moulded plastics were used. This is a highly important consideration accounting for the use of a machining, as distinct from a moulding, plastic in numerous fabricated products. The fabricator uses standard light and relatively inexpensive machines for converting the cast plastic into finished products.

A large proportion of the parts produced from cast resin are cut from stock or from other "special"-shaped rods or tubes. This applies not only to buttons and

Cleaving machine for cutting blanks from rods.

Lathe with foot-operated chuck for facing blanks.

buckle blanks, the latter often being made from tubes with two holes, but to scores of other items which can be made from blanks of similar sectional shape. Machining usually starts with making the blank. This blank can be cut off with a thin abrasive wheel, with a circular or band saw, with a lathe tool or in a special slicing machine. All except the last named result in some waste equal to the width of cut, but these operations are entirely feasible and extensively used. Slicing machines make use of a reciprocating knife, which cuts without waste but requires the use of a somewhat specially cured material which can be softened temporarily by heating, as in water at or somewhat below boiling temperature. When thus softened the resin cuts easily, sometimes several rods being sliced simultaneously with a single knife at each stroke. The cut has a smooth surface and the heating results in bringing the hardness of the blank, which is cooled by dropping into water, up to normal. Much cutting is done, however, with abrasive wheels, which also make a smooth cut and do so with fair rapidity. Such cutting is done wet. The water, which plays in a steady stream on the cut, avoids any chance of over-heating the plastic if the wheel should be forced too rapidly. Wheels commonly used are about 1/32 in. thick, and a 10-in. wheel turning at about 3,750 r.p.m. gives the correct cutting speed.

Sawing, whether for cut-off or for other operations, is done with a tooth speed of about 1,200 ft. to 1,300 ft. a minute with saws having 14 teeth to 15 teeth per in. and sufficient tooth "set" to clear the blade. Saws are likely to leave a surface somewhat less smooth than an abrasive wheel or cleaving knife, but the saw marks are readily removed by subsequent sanding and "cutting-down" operations, the latter accomplished in tumbling, as later explained. Flat blanks and discs are readily cut off and often are finished on faces, edges and backs in lathe operations, but it is usually more economical, especially for parts such as buttons, generally required in large quantities, to cut the blank in a slicing or some other preliminary operation.

Turning operations, whether on buttons or other parts, are done mostly in light, high-speed, hand-controlled lathes, often fitted with a contracting chuck, which need not be stopped for loading and unloading, and frequently having the tool mounted on a lever-controlled slide arranged for rapid traverse. In turning, as in all machining on this type of material, high speed with light cuts are recommended, as this

Another type of machine used for facing blanks.

Carving on blanks is done with rapidly revolving burrs or abrasive cutters.

avoids any tendency to overheat the work and, if the tool is kept sharp, yields the best surface finish. In automatic machines the resin blanks are sometimes fed from a hopper, but on hand machines the blanks are usually loaded by hand, the chuck being opened by foot pressure on a pedal and closed automatically by a spring when the foot is raised.

On hand machines for facing operations, spindle speeds are usually between 400 r.p.m. and 500 r.p.m., but on some automatic machines, in which the tool is sharpened after each cut, speeds of 3,500 r.p.m. or higher are employed. Many machines formerly employed in turning casein, celluloid, natural pearl and other button materials are readily converted for use on cast resin.

Tools for machining resin are sharpened, as a rule, much as for cutting brass and other soft metals, using a generous clearance (15 degrees to 18 degrees) and a rake of zero degrees or slightly negative. Grinding of drills and lathe tools is little different from normal. Ordinary hardened carbon steel tools are satisfactory for most work, but all tools must be kept sharp. In certain cases, where quantities are large and it is desired that sharpening be minimized, tools tipped with tungsten carbide give excellent results, although they are seldom essential.

Drilling is readily done on any machine with a high-speed spindle, preferably 2,500 r.p.m. or higher, and almost any sensitive drill press may be employed. Drilling is done dry except in the case of deep holes, when a non-alkaline lubricant may be employed. Some drilling is carried out on special machines with drills which perform both drilling and countersinking operations simultaneously and often arranged to drill from both sides. The blanks are generally fed automatically from hoppers and are indexed automatically in some cases. Machines can be had which drill two or four closely spaced holes at the same time and which in some cases also cut a "fish eye," quick-acting chucks being employed to hold the button when this is loaded by hand.

Button and other blanks from about 0.070 in. to 0.080 in. thick can be pressed after heating and the holes can be punched in the same operation. Material which is not fully cured, is used, the process of heating completing the cure. Such work is done, as a rule, in simple "kick" (foot-operated) presses, the dies being arranged to form a design, usually embossed, in which only a relatively slight flow of the plastic is required. This pressing yields a wide variety of designs and is well suited for making fancy articles of large variety.

Intricate blanks are often cut out of sheet.

Cutting down in pumice and polishing in tumbling barrels.

A corner of a store of stock sizes of cast resin tubes, rods, etc.
(Kind permission of Catalin, Ltd.)

Heating should be carefully controlled, however, to avoid breakage and colour change.

Thousands of attractive designs may be produced from cast resin by carving, carried out by skilled operators who guide the work by hand. Special steel cutters or "burrs" or abrasive cutting wheels turning at high speed, usually 4,000 r.p.m. to 6,000 r.p.m. or higher, depending partly on the type of cutter and its diameter, are used. Cuts made are commonly V-shaped and vary from fine to course, as required in varying designs. Skilled operators can produce seemingly complex designs with great rapidity.

Blanks of irregular shape are often cut from sheet stock using band or jig saws, which are also used for elaborate decorative cut-out work.

All cutting operations leave a frosted surface and many of them leave tool marks which must be removed to make a marketable product. Ashing, that is, wet buffing with pumice, is sometimes done as a preliminary to polishing. This leaves a smooth, but frosted, surface which readily gives a high polish on a dry muslin buff, using a special wax polishing compound. This operation is done quite rapidly and with the work guided by hand.

Similar results are obtained on small parts, such as pipe-stems and motorcar parts, with suitable dry tumbling in maple-lined barrels. The length of the tumbling depends upon the initial smoothness of the work, the character of finish required, the type of equipment, the compounds used, and other factors. Octagonal barrels about 30 ins. in diameter and turning 40 r.p.m. to 45 r.p.m. are commonly used. The initial roughing, or "cutting-down" tumble, is done with grade "00" pumice and usually requires 18 hrs. to 24 hrs., wooden shoe pegs being added to produce friction. This operation removes tool marks and rounds sharp corners, but leaves the work with a frosted surface. Pumice is then removed by sifting and a short tumbling in damp hard-wood sawdust, as it is essential that all pumice be absent before final polishing. The latter is done by tumbling with clean shoe pegs and a suitable wax compound, usually for 24 hrs. to 35 hrs. A tumble polish of this character is adequate for most products.

Plastic Closures Win in British Packing Contest

PLASTIC mouldings have a prominent share in the range of containers for Fontaine toilet products recently placed on the market by Fontaine (Perfumes), Ltd., of Castle Bromwich, Birmingham.

For beauty preparations beautiful containers are almost essential, and the standard of design here has for long been higher than the standards in most other industries that make use of packaging in any shape.

But the Fontaine containers set perhaps a higher standard of beauty—and efficiency—than has been achieved before. So, at least, seven business and advertising men think, for the seven judges in *Shelf Appeal's* recent British packaging contest gave the major award "for the outstanding packaging and merchandising achievement" to the Fontaine packs.

They were designed by Consultants, Ltd., and the plastic components were moulded by Synplas, Ltd.

One item in the range is a bath foam powder, and the container for this (in addition to its moulded closure) has a neat spoon for ladling out the contents. This was also moulded by Synplas, and fits into a tray under the lid.

On all the various Fontaine bottles are used plastic closures of a shape that has been registered by the designers. This is stepped, with a milled edge. On the smaller sizes there is a spot of colour in the centre of the closure; on the larger sizes, where more space is available, there is the word Fontaine, with a line round it, embossed and left in the same colour as the rest of the closure.

What Plastics Are

V.—MISCELLANEOUS SYNTHETIC RESINS

By H. Courtney Bryson

AS has been pointed out in a previous article, the first synthetic resin to be produced was made by reacting phenol (carbolic acid) with formalin, and these Bakelite resins still remain the most important. Besides the urea or amino resins, which were discussed last month, there is a very large number of other kinds of synthetic resin, of which a small number have properties sufficiently valuable to make them of use in spite of their high price.

Although cumarone resins are neither expensive nor spectacular, they are used to a wide extent in varnishes, printing ink, waterproof materials, rubber, floor tiles and chewing gum. Their use in moulding compositions is limited by the fact that they are rather brittle and are not heat hardening. They are produced from a water-white coal-tar fraction by heat treatment in the presence of a small quantity of acid and are characterized by their extreme inertness, as they are proof against both acids and alkalies. Although they can be made quite pale in colour, they turn yellow on exposure.

Of immense and rapidly growing importance are the alkyd resins produced by the reaction of phthalic anhydride and glycerine when heated to a high temperature. The product is a rubbery, clear solid which may be moulded with a little difficulty and possesses slow, heat-hardening properties. In actual practice mouldings are not made from this resin. It is used solely to replace natural resins in varnish. Its outstanding characteristics are its great adhesive properties on all surfaces and its pale colour. When the resin is made in the presence of drying oils the resulting product forms the basis of the "Synthetic" paints which are rapidly displacing other types on account of their quick drying, durability, lustre and adhesion.

Resins produced by polymerizing vinyl chloride and vinyl acetate (made from acetylene) are of great interest to the moulding trade on account of their transparency and water-white colour. The German resins Mipolam, Mowilith (I.G. Farbenindustrie) and the American resin Vinylite (Carbide and Carbon Chemicals Corporation) are both such resins. In America the latter company have fitted up display rooms in which practically every constituent part consists wholly or partly of a vinyl resin, including the wall panels, the floor tiles, the ceiling, doors, translucent windows and the paint. Those interested in the subject should refer to the comprehensive article published in *Industrial and Engineering Chemistry* (1933, 25, 648).

Vinyl resins are used in the U.S.A. in place of shellac in the manufacture of gramophone records. A 16-in. semi-flexible vinyl-resin record weighs 4 oz. and has the same playing time as a 20-in. standard record weighing 20 ozs. The surface noise is also much less. Dentures are made from this resin and can be given the delicate translucent pinkish tint of flesh, impossible to obtain with vulcanite. It is also used as a constituent of the chewing gum "Chix." Vinyl resins may be moulded by the injection process. The other uses which have been proposed for this resin would fill this journal. Transparent wrapping papers, linoleum, electric light bulb varnish, anti-rust varnish, inks, adhesive for safety glass, artificial leather, non-crease fabric solution and artificial silk may be mentioned as a few of the actual or potential uses.

Acrylic acid is a colourless liquid boiling at 141 degrees C., possessing lacrymosary properties. Its derivatives form a series of compounds with rapidly increasing importance in the plastics field. The organic glass Perspex, sold by the I.C.I. and described in the last issue of *Plastics*, is made from polymerized methyl methacrylate. It is even more transparent than ordinary glass, is extremely strong and non-warping and possesses the extremely important property of not discolouring with passage of time. Its chief defect is that it has a rather softer surface than glass and is, therefore, liable to be scratched. Other derivatives of acrylic acid are used as adhesives, and were it not for the price question would probably be very popular, since their adhesive properties are remarkable and are, in general, better than that of any other known material.

Victron (Naugatuch Chemical Co.), Resoflaz (Advance Solvents and Chemical Corporation) and Trolitul (I.G. Farbenindustrie) are the names of three resins prepared by converting styrene, a colourless liquid boiling at 142 degrees C. and made from benzene and acetylene into a hard, colourless and remarkably tough product with valuable properties and possibilities. Resins from styrene are actually among the oldest of synthetic resins, as they were mentioned by Simon in 1839. The properties of styrene may best be thought of as if it were rubber that had been cooled to a low temperature. It may be cut into thin films or shavings, but it cannot be pulverized.

Styrene may be moulded under pressure (half a ton per sq. in.), preferably at a high temperature, say, 175 degrees C., as this eliminates cracking on ageing. No heat hardening occurs, but the mouldings are stated to be stronger than Bakelite and have a higher insulation resistance than almost any other known product. Styrene resins are quite easily moulded by injection. The resin is an excellent laminating material for safety glass. The lack of a cheap source of styrene, and consequent high price, restricts the use of this most interesting material. Styrene occurs ready formed in coal-tar light-oil fractions, and also constitutes a nuisance in motor benzol and industrial gas on account of its gum-forming tendencies.

In recent years a whole series of resinous bodies have been made by treating raw rubber chemically. The most interesting of these resins is that resulting from treatment with chlorine. With high percentages of chlorine a resin is produced which may be moulded and which may be dissolved in solvents to give a coating for metals which is extremely resistant to attack by most chemicals.

PRODUCTION

Practical Information dealing with Raw Materials, Moulding and Forming of all types of Plastics—Thermo-Hardening and Thermo-Plastic—Works-Organization, New Plant and Control Apparatus

NOTES AND COMMENTS

A Plastics Centre

A READER has asked us our opinion of the possibility of starting a Plastics Centre, similar to the Building Centre situated in 158, New Bond Street, London, W., which shows builders and the public the most up-to-date materials available for the building industry.

This is an excellent suggestion. Such a centre would serve a very worthy purpose, not only in showing the public what is available, but would also be of great help to industrialists who may be considering the utilization of plastics in some form or other. There is little doubt that industry as a whole would welcome a movement that would explain plastics in a reasonable manner.

The Building Centre was first started in 1932 and has since proved a great success. Here a large number of manufacturers have their stands, provided at a rental, at which each shows a range of their latest products—for heating, lighting equipment, and so on. We noted that Evered Roanoid, Ltd., and Metro-Vickers, Ltd., exhibit a variety of plastic goods, such as door and bathroom furniture and tiles.

The Building Centre is open free to anyone interested in building, decoration or equipment. Every branch of the manufacturing world connected with building is represented, and it is possible to see samples of materials and equipment of every type needed to complete a building. It is not possible to purchase goods, but the visitor can see what the manufacturer has to offer in the way of new materials and new ideas, besides a very wide range of standard materials, such as timbers, marbles, stones, etc.

The Centre maintains its own staff for the purpose of giving information in a completely unbiased manner. Exhibitions consisting of displays for particular industries, as well as lectures by experts, are arranged periodically.

We believe that a Plastics Centre, built on similar lines, would prove of immense help in publicizing plastics in a real concrete way. The variety of objects that could be shown, together with their beauty, would attract the public as no other collection of goods.

We presume, however, that the plastics display would be somewhat different from the Building Centre. Here the exhibit is collected for one industry, and one industry only. The Plastics Centre would serve a dozen or more: electrical, chemical, aviation, furniture, automotive, jewellery, art, fancy goods, packaging, radio, household goods, and almost any more one wishes to include.

Still, we do not consider this a drawback in any sense. In fact, the Plastics Centre would be open to the world and his wife, which is exactly what we want. If it were considered that there would be too much overlapping, since moulders, as distinct from other plastics fabricators, can produce mouldings for any of the above sections, their separate categories could be arranged.

This is a job for a body such as the British Plastics Federation. We pass on the idea with a little prayer for its development.

Tracking of Moulded Articles for Electrical Use

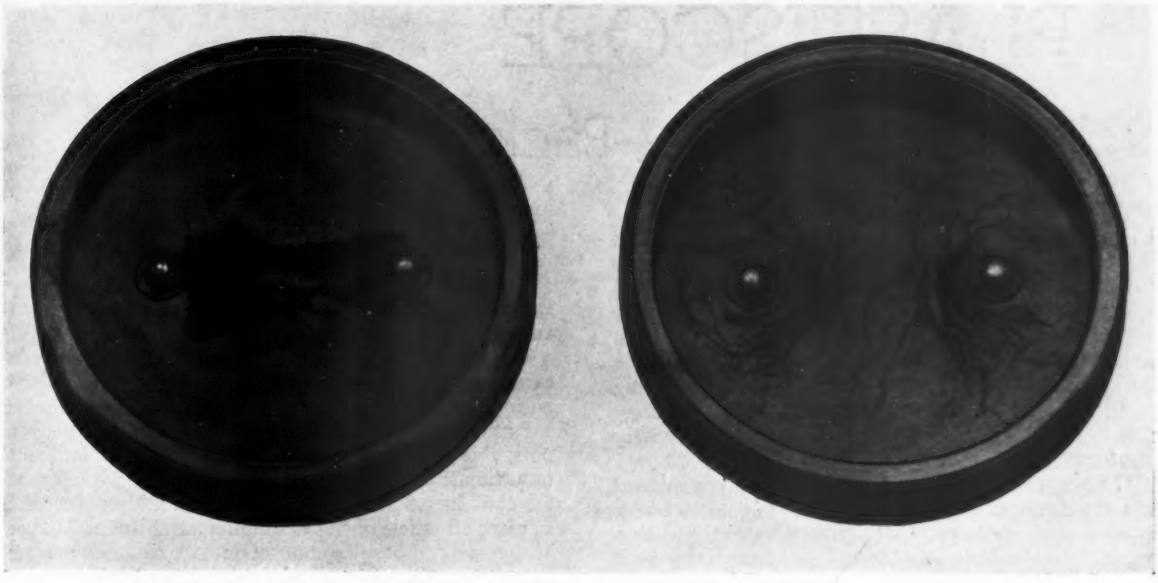
We have received the following notes on this important subject from British Industrial Plastics, Ltd.:—

The test here described has been designed to show the effect on moulded articles for electrical use of a serious current leakage over the surface, such as might occur in practice due to accumulation of dirt and damp.

An alternating potential of 200-220 volts is applied to two metal inserts in the moulding. The inserts may be moulded in or tapped in, whichever is the more convenient, and should be from ½ in. to 1½ in. apart. A current-limiting device is included in the circuit. A choke with a rating of 15 amps. is used for this purpose.

The circuit is completed by pouring a small quantity of a 10 per cent. solution of common salt on the surface of the moulding, between the inserts. The current boils this solution and drives off the water, leaving an uneven coat of dry salt on the moulding. Some current leakage occurs across this film, and is accompanied by incandescence of a few of the particles of salt.

With pheno-plastic mouldings, after even one or two applications of salt solution, serious surface leakage occurs, and a conducting carbon track is formed between the electrodes, with consequent arcing and a



(Left) A phenol resin moulding and (right) an amino resin moulding under the stringent test.

complete breakdown of the moulding. This is well illustrated in the left-hand disc, which has developed a marked track after only a single application of solution.

With Scarab mouldings, however, a little etching of the surface of the moulding by these heated particles is the only effect, repeated applications of the salt solution only producing further slight etching. When the salt solution is washed off the resistivity of the Scarab material will be found to be unimpaired. The right-hand disc illustrated is made from Scarab; it has been subjected to six applications of solution, after which there is no sign whatever of tracking between the terminals.

THE ADANA PROCESS

ONE of the bugbears of moulders has been the production of decorative effects and letterings on moulded articles made from plastic materials.

Obviously, this can be done in relief designs, but this means higher mould costs and generally the relief in the same colour as the base. Again obviously, it can be done with transfers in a variety of colours, but the results are usually poor.

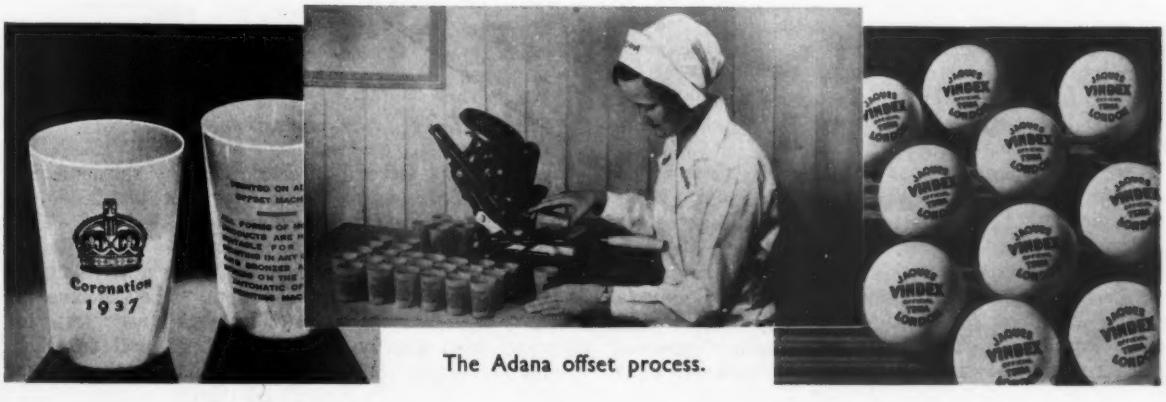
Other methods are by heat embossing and by pre-printing either with letterpress, litho or gravure. Some results are good, but most suffer from high cost.

The Adana offset process is extremely speedy and economical, one of the most important points in the new method being the application of inks specially devised for plastic goods. These inks are extremely durable and will stand up to considerable rubbing

In other words, the manufacturers have realized an important fact, that an ink suitable for printing on one material is not necessarily suitable for another. Thus, cellulose-acetate mouldings require an ink of rather different composition from that used on phenol plastics.

The machine is similar to a standard machine, the major difference is that the hard platen is replaced by a pad of resilient, yet tough, composition, which takes the impression from the type or engraved block. This impression is then transferred to the article by pressing or rolling the latter on to the resilient pad.

The whole method is extremely ingenious, for this resilience allows of printing perfectly on rounded objects.



The Adana offset process.

PLASTISCOPE

No. 4.—Packaging

By G. N. HIGGS

PRACTICAL plastic packaging has not, up to the present, received a reasonable opportunity amongst the older and better-known materials, of which the industrial designer of to-day has ample textbook information and knowledge.

There are many methods in the production of plastics which, by careful consideration, can be utilized to give the desired effect in design without unduly increasing costs, and as we hear from so many expert sources that it is the container which sells the goods, surely greater advantage should be taken of these possibilities?

The packaging of all kinds of products can be divided into three classes, although in most cases it is necessary to deal with each particular proposition on its own merits. In the first class there is the container which is thrown away immediately it is opened. Here it is necessary for reasonably large orders to be placed at a time, but this also applies to other competitive materials.

More particularly with plastics, very careful consideration must be given to the most economical methods of manufacture when creating a design of an appealing character. For instance, a cheap-looking and shoddy plastic container does not necessarily denote low cost, and frequently a design of genuine appeal can be evolved having lower manufacturing costs than many others which appear to be of a more inferior type.

The plastic, or moulded, container being such a superior article in appearance, in comparison with other materials used for the "immediate throw-away" type of container, it will be found that in most cases one is easily persuaded to consider the use of the same package for another purpose entirely, so soon as it has completed the work which is first required of it. This type of package I will refer to later under the particular name which it has been given, i.e., "Dual Packaging," and is referred to in these notes as the third class.

In the second class is included that in which the product is kept or stored during use, and here we have hosts of examples. It is only necessary to spend an hour or so in the shops with a person who is fully conversant with moulding processes and moulding-tool design to be convinced of the enormous possibilities of plastic mouldings and the numerous ways in which containers used for marketing products of all kinds can be thus improved.

It is unfortunate that those to whom the work of producing a design of a certain article is entrusted do not consider the conditions under practical use more thoroughly. For instance, shaving-stick containers; of these we have many kinds, including both upright and inverted types, round, square and hexagonal, all for which special claims are made. We have yet to see an article of this description which prevents the surplus soap from accumulating around the inside of the body and allows the drainings to run away quickly before it is packed away in one's travelling case.

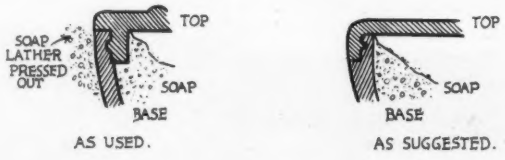
Again, a famous ketchup bottle, which has long been on the market, is one of the most impracticable propositions I have yet seen. It is top-heavy and is very easily knocked over, while it cannot be used without drips running down the outside. A small moulded stand would enable this type of bottle to remain upright and, at the same time, would collect all drips; moreover, a fairly close-fitting cover of plastic material, or even cardboard, to fit over the moulded stand would produce an ideal package.

I have noticed pepper being sold complete in pepper pots; this is certainly a step in the right direction, but unfortunately marred by the appearance and quality of the container. Very few purchasers would condescend to place an article of this description on their food table. My greatest surprise in connection with moulded pepper pots is that the majority of those made in this country have been so carefully arranged by their respective designers that when being filled the sprinkling holes are face downwards and the pepper falls through these holes almost as quickly as it is put in. There is room for improvement in all condiment sets that I have inspected up to the present in this country. Very practical designs are those moulded by The Imperial Molded

"Sani-trete" condiment closures.

Products Corporation of Chicago, U.S.A., under the trade name of "Sani-trete."

In the standard soap bowl containers one fault is specially noted. This appears to be very predominant in the designs of those manufactured up to the present. On the better-class types the usual three- or four-start thread for attaching the cap to the base is used, and in the majority of cases it is arranged that the male portion of the thread is on the cap and the female on the base.

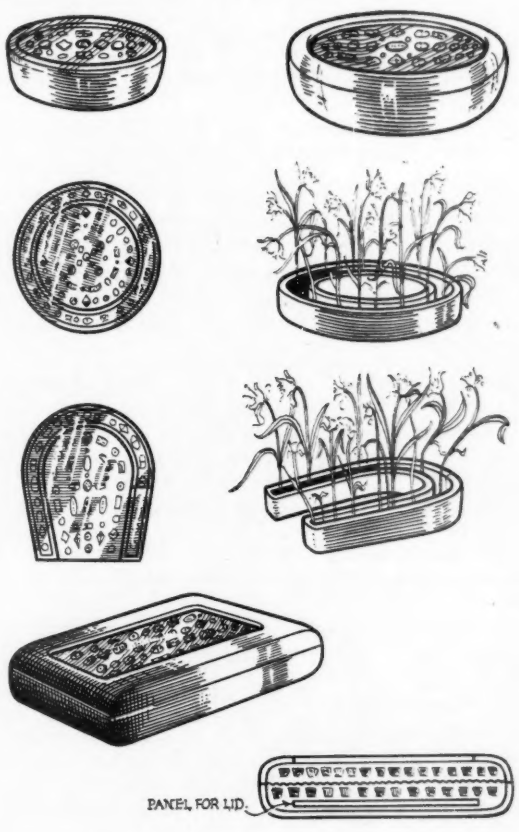


When this is screwed in after use, any surplus soap lather on the edges of the base, or even just inside, is pressed out and runs down the edge of the bowl. The attached sketch will, I think, explain.

Another scheme under class 2 is by a well-known firm of safety-match manufacturers. They include in a packet of a dozen boxes of matches a metal case to fit one box, usually decorated with a floral or other suitable design. This is an excellent idea for the house

or flat, but the metal box is not very acceptable to the average smoker. Both the metal case and the wooden box, with their sharp edges and corners, naturally cause abnormal wear to the pocket linings. Would it not be more to the point to include in these packets of a dozen, or perhaps every third packet, a well-moulded case with all edges and corners well rounded?

The use of transparent cellulose wrapping material, together with a moulded container, opens up an enormous scope for this combination in the dual-packaging class. Industrial designers generally do not appear to have fully realized the advantages of this scheme up to the present. For example, chocolate and confectionery bowls can be used for holding flowers. The cheaper kind of bowl can be moulded in one piece and the more expensive type of a two-piece moulding, in which the top rim is used to fix the transparent



Some suggested "Dual Packages."

wrapping, and at the same time will prevent the water from spilling over when in use for its second purpose.

The more recent types of circular and horseshoe trough vases can be made use of with distinct advantage; for instance, the actual trough can be loaded with one kind of confectionery and that of another can be packed in the centre. There can be no mistake that the public will always purchase goods, especially those which are edible, when displayed in a transparent container.

In the sketch of the oblong casket, which can be used for packaging all kinds of confectionery, preserved fruits, cakes, biscuits, handkerchiefs, gloves and cigarettes, it will be noted that I have included a spare moulded panel which, in the first place, can be packed in the bottom of the box and which, after use, can be fixed into the lid frame permanently. This lid frame will also hold the transparent wrapping in position in the first packaging.

Another dual-packaging suggestion, more particularly of interest to makers of patent cereal foods, can be treated in the same manner. The usual square containers for storing tea, coffee, rice, and so on, can be put up with the product that is offered for sale and covered with transparent wrapping, which would have all descriptive and advertising matter printed thereon. Users would naturally wish to obtain the complete set, which can be continually added to, to keep the scheme carrying on in a satisfactory manner for the longest period possible.

I see no reason whatever why medium-size packing cases should not be moulded in a coarser material, possibly soya bean meal, after the oil, which is used for other purposes, has been extracted. I was most interested in the research work that had been carried out by the Ford Co. at Dearborn, Detroit, U.S.A., both at their laboratory at the Edison Institute and their experimental department at their Rouge Plant. I am not aware that any other particular use has been found for this meal, and although they have made really wonderful progress at Dearborn the quality and general finish did not in any way compare with the same mouldings in "Durez," of which they were using large quantities. I anticipate that many of the large soap manufacturers in this country must have thousands of tons of this meal for disposal. Use might be made of it for moulded packing cases, if suitably reinforced.

This question of dual-packaging packages should receive the careful attention of many of the large manufacturing concerns and their advertising agents. I have already mentioned shaving-soap-stick containers; it might be found to be a temptation to the purchasing public to buy, say, 1 doz., or even ½ doz., complete sticks and containers if they were packed in a moulded casket which could be used for storing cigarettes, ties, handkerchiefs, playing cards, etc.

Again, ink should be retailed in a respectable moulded inkstand, such as has been lately made in America, with the inkpot fitting into the moulding as a refill.

Since writing my last Plastiscope notes I have had the opportunity of making an inspection of many of the leading stores in Holland, and was interested to note that, with few exceptions, the prices charged for plastics are definitely higher than those existing in this country. I recognized quite a few of our English standard mouldings and a number emanating from other European countries. There were also a few from the U.S.A., but the majority were of black and other dark phenolic material manufactured by Philips. Packaging in general was interesting, and the one particular detail which struck me most forcibly, and which should be given very careful consideration by all those exporting their goods to foreign countries, was that only a few of our National Advertising concerns appear to have troubled to print the outside covers of their packages and display cards in Dutch. I am quite prepared to admit that in Holland both English and German are spoken by quite a few, but the large majority of the Dutch purchasing public have no knowledge whatever as to the meaning of the very carefully worded advertising matter prepared by experts to promote sales. These remarks apply equally to both English and American manufacturers; nearly all other European and Japanese concerns importing their wares into Holland have had their labels and cartons translated and printed in Dutch.

Inquiries and Answers

Rubber and Resins

London.

To the Editor, *Plastics*.

Sir,—I am interested in fillers for use with synthetic resins and similar materials, and would be glad to know if any attempts have been made to use rubber instead of, say, wood flour, to give increased flexibility to the finished moulding. F.A.P.

[EDITOR'S NOTE.—I do not believe any moulder is at present using such a mixture, but it has obvious possibilities in view of the research work that has been carried out by Morgan and Pratt at the Chemical Research Laboratory, Teddington, Middlesex.

Mixtures ranging from 90 parts resin and 10 parts rubber to 10 parts resin and 90 parts rubber were prepared from vulcanized rubber made from latex dispersed in benzene, which was then mixed with a solution of Bakelite resin in acetone. After removal of solvent, the residue was a thick syrup, which slowly hardened to a solid mass. This was powdered, sieved and moulded at 150 degrees C. to yield preparations which became increasingly resilient as the proportion of vulcanized rubber exceeded 50 per cent.

Breakdown voltage tests:—

Rubber	(10) resin	(90)	750	R.M.S. Volts/Mil.	
,,	(20) ,,	(80)	1,030	,,	,,
,,	(40) ,,	(60)	810	,,	,,
Wood meal	(66) ,,	(33)	750	,,	,,

Experiments using chlorinated rubber instead of vulcanized rubber gave better results.

The reader might be interested in the new Thiokol rubber moulding powder. Mixed with moulding powder of the synthetic-resin type, this might give valuable results.]

Home-recording Discs

Ilford, Essex.

To the Editor, *Plastics*.

Sir,—A friend of mine introduced me to the September issue of your new periodical, and it so interested me that I have now purchased the three back numbers.

I am not a plastic technologist, but a branch of my work touches the subject, and to me the name of H. Courtney Bryson is sufficient attraction to continue reading *Plastics*, which, apart from its valuable subject-matter, is well printed on good-quality paper and contains many excellent illustrations.

Two years ago I had the pleasure of reviewing Mr. Bryson's book, "The Gramophone Record," and so I know that matters relating to the commercial solid stock record will not be forgotten; and although it is true, as Mr. Bryson stated in his first article (page 3, June, 1937), that the gramophone industry has now shrunk to small dimensions, I would like to mention a fairly recent application of gramophonics that is expanding rapidly.

I refer to composition direct or instantaneous recording blanks (discs) for so-called personal or home recording, which includes the large number of blanks employed for recording sponsored programmes for transmission from Continental radio stations and for various recorded B.B.C. programmes.

So far as I am aware, no accurate figures are available giving the number of blanks produced and used in this country, but it is certainly not an insignificant figure; and in America, during 1935, it was estimated that 15,000,000 dollars were spent on recorded broadcasting, i.e., what are known as "transcriptions," and the amount rises annually.

For the benefit of interested readers I give a list of the main types of recording blanks in use to-day:—

1. Metal blanks, e.g., aluminium, tin, zinc and pewter.
2. Cellulose esters, with plasticizer. Includes blanks termed "cellulose-acetate" and "nitro-cellulose."
3. Thermo-setting phenolic resins. Hardened after "cutting" (recording) by baking.
4. Gelatine or gelatinous compositions.
5. Resinous compounds, other than (2) and (3).

I know many people, including myself, who would be delighted to see an article on the manufacture of these synthetic blanks, for I cannot find any published information. D.W.A.

[EDITOR'S NOTE.—The making of recording blanks for home use is very fascinating, but, of course, represents extremely difficult problems to get good reproduction. For example, the surface must be perfect; it must also be soft enough to be cut clean with the cutting instrument (usually diamond or sapphire) used for making the sound track, and yet, after treatment, hard enough to resist the continual action of the needle, and so to prevent obliteration of the wave form.

1. Cellulose-acetate or nitro-cellulose is used in France more than in this country. It would appear rather soft for the purpose, although good results have been obtained. The reader might consider the idea of covering a metal sheet or glass with benzyl cellulose (from a solution). This derivative of cellulose is stated to be somewhat harder than the acetate. It can be obtained from Imperial Chemical Industries, Ltd.

2. Thermo-setting resins. These surfaces are obtained by spraying or brushing synthetic resin lacquers of the phenol or amino type, and while still "uncured" recording the sound, and following this with a hardening process by baking in an oven. The difficulty here is that the "uncured" recording blank is sent from the manufacturer to the user in the home, and during the period between the two the resin hardens up considerably, making the recording no easy matter.

3. Gelatine compositions. This is fairly satisfactory, the composition being hardened after the sound track is made with formaldehyde or dichromate solution. The life is usually not great.

We shall endeavour to obtain further details to supplement the above.]

Cleaning Bakelite

To the Editor, *Plastics*.

Chelmsford.

Sir,—I should be glad to know the best method of keeping Bakelite table tops clean and highly polished. Are there any special preparations for the purpose? I usually use a wet cloth, which in time gives a dull finish. J.F.C.

[EDITOR'S NOTE.—As oils do not attack the Bakelite type of resin almost any petroleum oil mixture will do to remove dirt and grease; for example, Bluebell polish. In fact, ordinary kerosene will do, but will not give a lasting polish. Kerosene with a little wax in it cleans and gives a polish, and most proprietary motorcar polishes, which are composed generally of waxes, a fine abrasive and solvents, give excellent results. Do not, however, use soda or ordinary soap.]

Luminescent Plastics

Following up our comments on this subject last month, we have had two communications from foreign firms who produce luminous synthetic resins: Société des Produits Luminescents, 24, rue Vernet, Paris; and Sobelrecol of Liége, Belgium.

The first-named company have forwarded an interesting pamphlet on their Lufrolac resins and a sample of luminous moulded material made by the General Electric Co., who possess the sole rights for this production in France.

We have also had a visit from Mr. G. Noble, of 10, Ranelagh Drive, Edgware, Middlesex, who tells me he is able to supply luminescent moulding powders for producing the mouldings in this country. In France they are widely used, and not merely for stunt advertising purposes. We give some indication of their uses in this month's editorial on page 161.

Depositing Silver on Bakelite

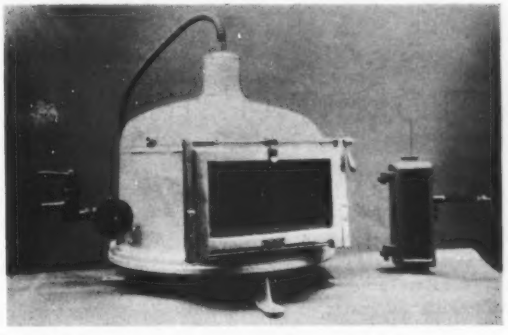
Messrs. W. Edwards and Co., of Vaughan Road, Loughborough Junction, London, S.E., comment on the reply we gave last month on this subject and, while agreeing that the method was quite suitable for depositing silver on glass, are doubtful whether it would be so for Bakelite, owing to the perfect surfaces needed for good results. It is also possible that traces of formaldehyde in the resin would affect the silver solution. They suggest that a new method recently perfected by them would probably be suitable.

The process is being used for the deposition of metals, silver, gold, etc., on to glass for such high-class work as telescopic mirrors, electrical research apparatus, and so on. It is called the "sputter" process and consists in the tearing-off under vacuum of tiny particles of metal from an anode by high-tension current and their deposition on to material to be coated.

The apparatus consists of a chamber fitted with a high-tension lead (800 volts to 1,000 volts at 60 milliamps to 100 milliamps), the anode consisting of the metal to be "sputtered" and deposited, while the cathode consists of a metal that cannot be "sputtered," such as aluminium. In between the anode and the cathode is placed the article to be coated. The chamber is maintained at a vacuum of 1 to 1/10th mm.

In passing, an interesting application of this process has been carried out by a well-known firm of dress designers, who have coated silk with gold metal.

Of course, if we are considering methods other than by using silver solution, we can also add the method of metal spraying, as carried out by what was originally called the Metallization Process, and now being developed by the British Oxygen Co. Metal wire, such as silver, copper, zinc, nickel, etc., is passed through



The Edwards' "Sputtering" Chamber.

an oxy-acetylene flame using a pistol-like apparatus and sprayed in very fine form on to the object. For moulded goods, it would be necessary to sand-blast first before good adhesion could be obtained.

A FRENCH MOULDED DISPLAY STAND

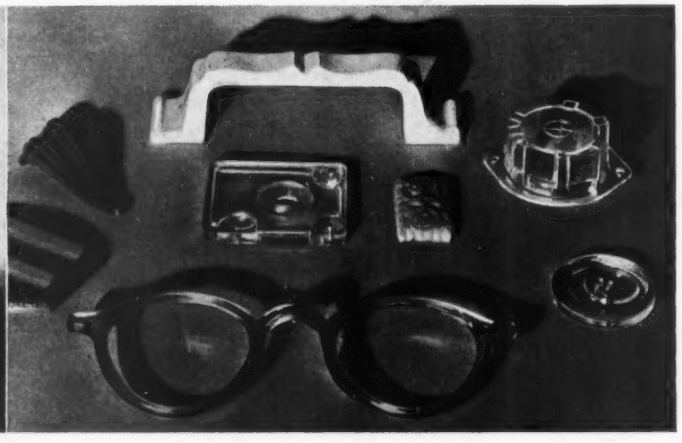
As an addition to Mr. Keller's article on moulded displays in our last issue, we have received from Manufacture d'Isolants et Objets Moulés, the well-known French moulding company of Vitry-sur-Seine,

a photograph of a stand they have produced for the famous French perfume manufacturers Roger et Gallet. Produced in the Bakelite-type of resin, it is of novel design and extremely strong.

NEW MATERIALS—NEW PLANT—NEW METHODS

AUTOMATIC INJECTION MOULDING MACHINE

This Continental injection moulding machine, made by Eckert and Ziegler, Cologne, Germany, which is fully automatic and capable of high output, was demonstrated at the recent Engineering and Machine Exhibition at Olympia. It is capable of turning out large mouldings weighing as much as half a pound, and the design may vary from optical frames to door handles, buttons and fancy ware. The finish is remarkably fine and the appearance of the goods fits them for the quality market. Both cellulose acetate and polystyrol moulding powders may be used. The examples of injection mouldings shown below illustrate a few of the articles which can be made with this machine. We understand that considerable interest was aroused by the appearance of this new type and it is reported that a large number of important trade inquiries is being dealt with by the English sales organization, which is Technical Machines and Accessories, Royal London House, 17, Finsbury Square, London, E.C.2. All inquiries regarding this machine should be addressed to the above concern.



Pumice for Plastics.

We have just received a reminder from Messrs. James H. Rhodes and Co., of Chicago, U.S.A., that pumice is finding increasing uses in the finishing of small mouldings, especially buttons. They send us a very interesting brochure dealing with the properties and uses of pumice. This volcanic rock-like substance must, to be at all suitable for fine polishing purposes, be very vesicular in texture. It must contain no quartz crystals, which scratch surfaces, and, in fact, no crystals of any kind.

The best pumice occurs in Italy, and in that country only on one of the very small islands off the Straits of Messina, Lipari by name. The Liparian pumice is of a peculiar vesicular formation, without quartz crystals or other disadvantageous minerals, and is, therefore, better as an abrasive than any other pumice in the world. When this pumice is rubbed down on a surface, these small vesicles or gas cavities wear down in such a way that the material that is rubbed is cut down but is not scratched. In other words, the polishing medium breaks down and abrades without scratching.

New Colour Measuring Device.

The "Specter" is a recording photo-electric spectrophotometer invented by Professor Arthur C. Hardy of the Massachusetts Institute of Technology for the scientific analysis of colour. In principle the apparatus utilizes the ability of the photographic cell to convert light waves into electrical energy, and the colour sample is recorded in the form of a wavy line on a graph. This gives at a glance the exact wave length of the paint, dye, moulding powder, or indeed any other material.

The first perfected model of the "Specter" cost five thousand dollars to construct and is now in daily use at the Research Laboratories of the International Printing Ink Corporation.

With this new scientific device it is anticipated that colours will in future be matched perfectly without even inspecting the actual colours. Study of the wave lengths on the graph will afford all the information necessary for the blending and improvement of all colours.

Crystalate Mouldings.

In our Directory of the plastics industry we have made reference to the Crystalate Manufacturing Co., Ltd., 60-62, City Road, London, E.C.1. This should have read Crystalate Mouldings, Moorgate Hall, 153, Moorgate, London, E.C.2.

TRADE AND FINANCIAL NOTES

Australian Imports of Transparent Paper.

The United Kingdom is now definitely the chief exporter of transparent cellulose wrapping into Australia, having superseded Japan, which country formerly did more than one-half of the total trade. During the first six months of 1937 imports from the United Kingdom totalled 1,087 cwt., against 407 cwt. in the corresponding period in 1936. Imports from Japan were 535 cwt., against 1,374 cwt. The only other important supplying country this year is France, with 410 cwt., against 21 cwt. There is a 20 per cent. ad valorem British customs preference. Statistics show that this country is also making considerable headway against foreign competitors in other Dominions.

Synthetic-rubber Production in United Kingdom

Manufacture of synthetic-rubber substitutes for 1935 is shown as 1,498 tons, as against 1,579 tons in 1934, according to the Preliminary Report No. 16 obtained under the Fifth Census of Production (1935) and published as a supplement to the *Board of Trade Journal*, August 26.

Increased Turnover of Triplex Glass

Mr. Graham Cunningham, chairman and managing director, speaking at the company's meeting on September 8, said that the combined footage turnover this year, including the well-known associate company, Messrs. Triplex (Northern), Ltd., was reported to have risen from 5,964,126 ft. (last year) to 7,652,985 ft., and it was also stated that the infringement action commenced by the Triplex Safety Glass Co. of North America had now entered on its tenth year, and there was reason to believe that finality was being reached, because that company had now received a partial payment of $1,000,000, in which the British company hoped to participate in due course.

Goodyear Tyre and Rubber Co. Results

This company reports a net profit of 8,068,352 dollars for the first six months of 1937, after setting aside 1,500,000 dollars as a special reserve for contingencies and adjusting both raw material inventories and future commitments to the lowering of cost or market. This compares with 3,598,683 dollars in the first half of 1926 and is the best six months' earning since 1929. After deducting dividend requirements on new 5 per cent. preferred outstanding June 30, and on unexchanged shares of old 7 per cent. preferred redeemed July 1, earnings amounted to 3.18 dollars a share on common, against 62 cents in the first half of 1936. Sales amounted to 116,475,701 dollars, against 90,908,685 dollars in the first half of 1936, an increase of 28 per cent.

Insulators, Ltd., moulders in Bakelite and allied plastics, have issued a new booklet, "Plastics in Modern Display and Packing." The booklet discusses the suitability of plastics for display units, containers, and novelties.

The **British Plastics Federation, Ltd.,** is holding a business luncheon at the Midland Hotel, Manchester, on October 7, at 12.45 p.m. for 1.15 p.m., tickets 6s. 6d. each.

The principal speaker will be the chairman of the Federation, **Mr. H. V. Potter,** B.Sc., F.I.C., M.I.Chem.E.

New Registrations.

Hydro-Plastics, Ltd., has been registered as a private company with a nominal capital of £21,000 in 20,000 ordinary shares of £1 each and 20,000 deferred shares of 1s. each. The objects of the company are to acquire and develop patents for the production of synthetic resin emulsion and to carry on the business of manufacturers of plastic moulding.

THE CHEMISTS' EXHIBITION

There was a good deal to interest the plastics trade at the **Chemists' Exhibition,** held in the Albert Hall, London, from September 20 to 24, which was well attended.

The United Glass Bottle Co., Ltd., showed a large selection of moulded caps for various types of bottles for all kinds of pharmaceutical and beauty preparations. On the question of price, these plastic caps are now available at very competitive figures and in consequence meet a rapidly growing demand. **The Armstrong Cork Co., Ltd.**, also exhibited an interesting selection of straight and fancy bottle caps.

At the stand of **Souplex, Ltd.,** of Morecambe, Lancs, **Mr. Nevison,** a director of the company, was present to meet the firm's many trade friends. He informed me that **Souplex, Ltd.,** is expanding rapidly and increased business has resulted in the installation of four new presses. Incidentally, this Lancashire company is now moulding for the general trade in addition to their ordinary output of phenol and urea mouldings for their safety razors and cases.

PATENTS RELATING TO PLASTICS

These abridgments of recently published specifications are specially compiled for this journa iby permission of the Controller of His Majesty's Stationery Office. Group abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet, as issued, on payment of 5s. per group volume, or in bound volumes, price 2s. each, and the full specifications can be obtained from the same address, price 1s. each.

467,234. Phenol-aldehyde Condensation Products.

BAKELITE, LTD. December 10, 1935.

Oil-soluble resins are derived from xylenol by separating crude xylenol by distillations into fractions the components of which show substantial uniformity with respect to rate of reaction with aldehydic substances, reacting the fractions with an aldehydic substance under varying reaction conditions corresponding to the varying reactivity with the aldehydic substance and blending the various products so obtained. Alternatively the various fractions may be reacted in the same mass in the order of their increasing reactivity. Other phenolic substances showing a similar rate of reactivity may be blended with the fractions. Aldehydic substances include formaldehyde, hexamethylene tetramine, acetaldehyde, benzaldehyde, furfuraldehyde or ketones.

467,434. Resinous Condensation and Polymerization Products.

CARBORUNDUM CO. December 16, 1935.

A mouldable mix for making abrasive articles comprises abrasive grains, powdered fusible resin and a plasticizer comprising an aqueous alkaline solution of normally solid resin or of resin which is plastic but not readily flowable. The plasticizer may be added as such or formed in situ, e.g. by wetting the grain with solvent and mixing it with a mixture of powdered fusible resin and soluble resin or by mixing the wetted grain with soluble resin and then adding powdered fusible resin.

466,304. Isomerized Rubber.

OKONITE CO. March 20, 1936.

An electric conductor is insulated with a film consisting of a halide addition product, a polymer, or an oxide of rubber. The film may be wrapped helically or longitudinally on the conductor and the layers or turns fused together by heat, so that a practically solid insulation layer results. The films may be produced on a heated rotating drum which dips into the insulating material, or a solution thereof, the drum taking up a thin sheet of the material which is subsequently peeled off the drum.

466,375. Rubber Compositions.

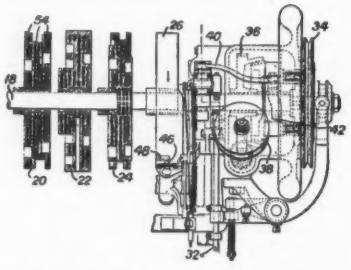
CROWN CORK AND SEAL CO., Inc. April 16, 1936.

The polymerized chlorobutadiene product known by the Registered Trade Mark "Duprene" is mixed with a predominating proportion by volume of finely divided fibrous material, and the mixture is vulcanized to give a composition for sealing and gasket purposes. The fibrous material may be cork, asbestos, paper pulp or disintegrated paper, or mixtures of these. The mixture may contain polymerized tung oil and stearic acid as softening agents, phenol aldehyde or urea aldehyde synthetic resin which is incorporated in an initial or intermediate stage and converted to its final state by the vulcanizing operation, cumar gum resin, natural resin and fillers such as whiting and talc.

467,822. Synthetic Resin Articles.

BRITISH UNITED SHOE MACHINERY CO., LTD. (United Shoe Machinery Corporation). December 19, 1935.

The cam members mounted on the main shaft of a sewing or like machine and which drive the various stitching, feeding or like members operating on the work are made wholly or mainly of synthetic resins. Preferably these cams, 20, 22, 24, 26 are made by hot pressing parallel layers 54 of canvas or like strong textile material in a matrix of synthetic resins, the product having lightness,



strength and durability. The cams may be impregnated with a lubricant such as graphite. To produce the cam-tracks or grooves, the canvas may be cut or shaped before impregnation and pressing.

467,491. Phenol-aldehyde Condensation Products.

PRUFER, H. November 11, 1935.

Moulded products are prepared by mixing a considerable excess of fibrous material (such as wood meal, sawdust, wood felt, sugar cane, wood pulp, cork meal, asbestos, leather waste, textile fibres or pulverulent material) with an aqueous hardenable artificial resin composition and working up the composition in known manner. The aqueous resin composition comprises an aqueous solution of an advanced stage phenol-aldehyde condensate that has been treated with an alkali metal hydroxide in which saponifiable fats, oils or wares or non-saponifiable fat-like substances are saponified or emulsified. The hardening of the product may be accelerated by the presence of alkali chromates, bichromate, manganese salts and metal oxides. Fireproofing agents such as phosphates, sulphates, chlorides, bromides, acetates, or water-glass may be added to the composition to increase the non-inflammability of the product. To produce loose-structure slabs the composition may be treated with an aqueous metal salt to precipitate the resin as an insoluble metal salt and the composition shaped and dried.

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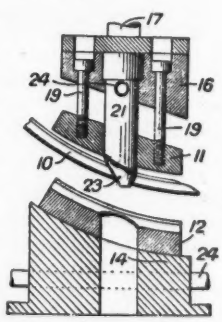
467,343. Moulding Celluloid Mudguards.

BLUEMEL BROS., LTD., and BLUEMEL, F. W. December 20, 1935



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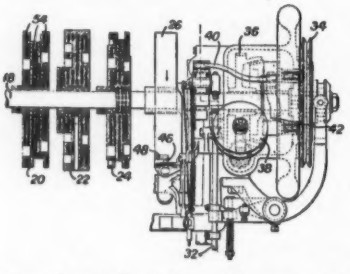

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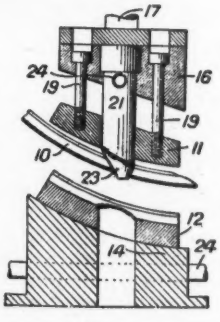

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